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Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERONAUTICS (GENERAL)

N76-26143* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 69
Apr. 1976 84 p refs
(NASA-SP-7037(69)) Avail: NTIS HC $4.00 CSCL 01A

This bibliography lists 305 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1976. Author

N76-26144* + National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 70
May 1976 71 p
(NASA-SP-7037(70)) Avail: NTIS HC $4.50 CSCL 01A

This bibliography lists 222 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1976. Author

N76-26145*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY MEASUREMENTS OF AIRCRAFT AIRFRAME NOISE WITH THE NASA CV-990 AIRCRAFT
Kenneth C. White, Paul L. Lasagna, and Terrill W. Putnam Jan. 1976 18 p refs
(NASA-TM-X-73116; A-6506) Avail: NTIS HC $3.50 CSCL 01A

Flight tests were conducted in a CV-990 jet transport with engines at idle power to investigate aircraft airframe noise. Test results showed that airframe noise was measured for the aircraft in the landing configuration. The results agreed well with the expected variation with the fifth power of velocity. For the aircraft in the clean configuraton, it was concluded that airframe noise was measured only at higher airspeeds with engine idle noise present at lower speeds. The data show that landing gear and flaps make a significant contribution to airframe noise. Author

N76-26146*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
WIND TUNNEL INVESTIGATION OF NACELLE-AIRFRAME INTERFERENCE AT MACH NUMBERS OF 0.9 TO 1.4 - PRESSURE DATA, VOLUME 1
Daniel P. Bencze Feb. 1976 440 p refs
(NASA-TM-X-73149; A-4982-Vol-1) Avail: NTIS HC $11.75 CSCL 01A

Detailed interference force and pressure data were obtained on a representative wing-body nacelle combination at Mach numbers of 0.9 to 1.4. The model consisted of a delta wing-body aerodynamic force model with four independently supported nacelles located beneath the wing-body combination. The model was mounted on a six component force balance, and the left hand wing was pressure instrumented. Each of the two right hand nacelles was mounted on a six component force balance housed in the thickness of the nacelle, while each of the left hand nacelles was pressure instrumented. The primary variables examined included Mach number, angle of attack, nacelle position, and nacelle mass flow ratio. Nacelle axial location, relative to both the wing-body combination and to each other, was the most important variable in determining the net interference among the components. Author

N76-26147*# National Aeronautics and Space Administration, Washington, D.C.
ORDERS OF MAGNITUDE: A HISTORY OF NACA AND NASA, 1915-1976
Frank W. Anderson 1976 107 p refs
(NASA-SP-4403) Avail: NTIS MF $2.25; SOD HC $2.20 CSCL 05D

A brief history of aeronautics and space exploration is presented. The Federal government's role in contributing, by research and development, to the advancement of aeronautics and space exploration is emphasized. The flight of man is traced from Kitty Hawk to walks and rides on the surface of the moon. Orbiting Solar Observatories, Orbiting Observatories, planetary exploration (Mariner Space Probes, Pioneer Space Probes) the Earth Resources Program, and Skylab are included. The development of the space shuttle is also discussed. J.M.S.

N76-26148*# Massachusetts Inst. of Tech., Cambridge.
A HANDBOOK FOR THE ESTIMATION OF AIRSIDE DELAYS AT MAJOR AIRPORTS (QUICK APPROXIMATION METHOD)
Amedeo R. Odoni and Peeter Kivestu Washington Jun. 1976 83 p refs
(Grant NsG-1123)
(NASA-CR-2644) Avail: NTIS HC $5.00 CSCL 01E

The handbook contains a set of curves that allow estimation of the average number of total daily delay minutes at a major airport under a variety of conditions. Demand profiles at each airport are classified with respect to the number of daily peak periods, the percentage of daily flights during peak periods, and the number of peak period operations at the airport. When combined with the saturation capacity of the airport, these descriptors provide sufficient information to allow usage of the handbook. Examples illustrating the use of the handbook are provided, as well as a brief review and description of the technical approach and of the computer package developed for this purpose. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N76-26149+ Transportation Systems Center, Cambridge, Mass.
AIRCRAFT WAKE VORTICES: AN ANNOTATED BIBLIOGRAPHY (1923-1975) Final Report
J. N. Hallock Jan. 1976 312 p refs
(AD-A023415/3; DOT-TSC-FAA-76-4; FAA-RD-76-43) Avail: NTIS HC $9.75 CSCL 20/4

An annotated bibliography is presented which consists of 570 abstracts of publications on aircraft wake vortices. The material is arranged alphabetically by year of publication and covers the time period through 1975. Experimental and theoretical articles are included. The formation, structure, motion, and decay of vortices and their effect on penetrating aircraft are considered. Author

N76-26150 Stanford Univ., Calif.
COMPUTATION OF STEADY TWO-DIMENSIONAL TRANSONIC FLOWS BY AN INTEGRAL EQUATION METHOD Ph.D. Thesis
Billy WanderaOgana 1976 205 p
Avail: Univ. Microfilms Order No. 76-13089

The nonlinear partial differential equation in the perturbation velocity potential and the boundary conditions which describe steady, inviscid, compressible subsonic-transonic flow past a thin two-dimensional airfoil, are transformed into a nonlinear singular integral equation in a perturbation velocity component. In the course of this transformation there arises a logarithmic singularity. Concepts from multidimensional singular integrals are used to justify enclosing the singularity in a vanishing rectangular cavity. By varying the aspect ratio of the cavity, different forms of the integral equation can be deduced. Of particular interest are the forms corresponding to cavities whose aspect ratios are unity and infinity. The domain of integration is divided into suitable arbitrary partitions and a numerical method developed which transforms the integral equation into a nonlinear matrix equation solvable by functional iteration. Dissert. Abstr.

N76-26151 California Inst. of Tech., Pasadena.
A STUDY OF THE TRAILING VORTICES BEHIND A RING WING Ph.D. Thesis
Kwasi Kete Bofah 1975 174 p
Avail: Univ. Microfilms Order No. 76-14247

The flow field of a laminar vortex wake behind a ring wing was investigated. Experiments were conducted in the GALCIT Low Speed Water Channel, using laser Doppler velocimetry techniques to measure vertical and axial velocity components in the trailing vortex wake. A thin cylindrical ring wing model was tested at various axial angles of attack and free stream velocities. Velocity profiles were measured at several downstream stations from the trailing edge to 45 wing diameters downstream. The inviscid roll-up of the trailing vortex sheet shed by a ring wing was numerically examined. A line vortex representation was used to calculate the evolution of the initially cylindrical vortex sheet. The vortex sheet was found to distort in shape and then smoothly roll up into a pair of doubly connected spirals whose centers originate from approximately the center of gravity of vorticity in the upper quadrants of the ring wing's circular trailing edge. (This origin is at an angle of 38 deg measured from the horizontal wing diameter.) The experimental and flow visualization results are consistent with the numerical data and show that a pair of counterrotating vortices do develop from the rolling up of the vortex sheet shed by a ring wing in a nonaxial flow.
Dissert. Abstr.

N76-26152*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NONLINEAR EQUATIONS OF MOTION FOR CANTILEVER ROTOR BLADES IN HOVER WITH PITCH LINK FLEXIBILITY, TWIST, PRECONE, DROOP, SWEEP, TORQUE OFFSET, AND BLADE ROOT OFFSET
Dewey H. Hodges (Army Air Mobility Research and Development Lab., Moffett Field, Calif.) May 1976 47 p refs Prepared in cooperation with Army Air Mobility Research and Development Lab., Moffett Field, Calif.
(NASA-TM-X-73112; A-6486) Avail: NTIS HC $4.00 CSCL 01A

Nonlinear equations of motion for a cantilever rotor blade are derived for the hovering flight condition. The blade is assumed to have twist, precone, droop, sweep, torque offset and blade root offset, and the elastic axis and the axes of center of mass, tension, and aerodynamic center coincident at the quarter chord. The blade is cantilevered in bending, but has a torsional root spring to simulate pitch link flexibility. Aerodynamic forces acting on the blade are derived from strip theory based on quasi-steady two-dimensional airfoil theory. The equations are hybrid, consisting of one integro-differential equation for root torsion and three integro-partial differential equations for flatwise and chordwise bending and elastic torsion. The equations are specialized for a uniform blade and reduced to nonlinear ordinary differential equations by Galerkin's method. They are linearized for small perturbation motions about the equilibrium operating condition. Modal analysis leads to formulation of a standard eigenvalue problem where the elements of the stability matrix depend on the solution of the equilibrium equations. Two different forms of the root torsion equation are derived that yield virtually identical numerical results. This provides a reasonable check for the accuracy of the equations. Author

N76-26153*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRANSONIC AERODYNAMIC CHARACTERISTICS OF A WING/BODY COMBINATION INCORPORATING JET FLAPS
John L. Holmberg Sep. 1975 137 p
(NASA-TM-X-62461; A-6203) Avail: NTIS HC $6.00 CSCL 01A

A 0.25-scale semispan wing/body model with two types of jet flaps was tested in the Ames 11- by 11-Foot Transonic Wind Tunnel. The objective of that testing was to measure the static aerodynamic forces and moments and wing pressure distributions on six configurations differentiated by wing camber, jet flap type, and jet flap angle. Maximum thrust coefficients were limited to 0.12. Angle of attack was varied from -4 deg to 15 deg for Mach numbers between 0.6 and 0.95 at a constant unit Reynolds number of 18.0 million/m (5.5 million/ft). More refined designs and considerably more testing will be required to establish the practicability of the total-exhausting jet flap concept. Author

N76-26154*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC PERFORMANCE OF TWO VARIABLE-PITCH FAN STAGES
Royce D. Moore and George Kovich 1976 12 p refs Proposed for Presentation at the 10th Congr. of the Intern. Council of the Aeronautical Sciences, Ottawa, 3-8 Oct. 1976; sponsored by the Am. Inst. of Aeronautics and Astronautics
(NASA-TM-X-73416; E-8658) Avail: NTIS HC $3.50 CSCL 01A

The NASA-Lewis Research Center is investigating a variety of fan stages applicable for short haul aircraft. These low-pressure-ratio low-speed fan stages may require variable-pitch rotor blades to provide optimum performance for the varied flight demands and for thrust reversal on landing. A number of the aerodynamic and structural compromises relating to the variable-pitch rotor blades are discussed. The aerodynamic performance of two variable-pitch fan stages operated at several rotor blade setting angles for both forward and reverse flow application are presented. Detailed radial surveys are presented for both forward and reverse flow. Author

N76-26155*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ACOUSTIC AND AERODYNAMIC EFFECTS OF ROTOR PITCH ANGLES FOR A VARIABLE PITCH, 6 FOOT DIAMETER FAN STAGE Technical Paper
Richard P. Woodward and Frederick W. Glaser 1976 20 p refs Presented at the 3rd Aero-Acoustics Conf., 20-23 Jul. 1976, Palo Alto, Calif. Sponsored by AIAA
(NASA-TM-X-73418; E-8753) Avail: NTIS CSCL 01A

An externally driven, 1.2 pressure ratio full-scale fan stage with an adjustable pitch rotor was tested in an outdoor facility at the Lewis Research Center. Rotor pitch angles resulting in minimum sideline perceived noise levels are defined as a function of stage thrust. Thrust-corrected fan noise variations are examined for operation at constant thrust, rotor tip speed, and stage work

coefficient. At constant stage thrust, reducing the rotor pitch angle below design values increased the fan noise with the greatest change occurring in the blade passing tone level. At constant fan speed the minimum noise occurred at a particular rotor pitch angle, which was not the minimum thrust condition. With constant stage work coefficient, rear quadrant noise increased at above-design speed conditions. Author

N76-26156# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE SEPARATED FLOW AROUND CONES WITH A TURBULENT BOUNDARY LAYER FOR MACH NUMBERS 8.3 AND 10
B. V. Bosheniatov, V. V. Zatoloka, and M. I. Iaroslavtsev [1975] 8 p refs Transl. into ENGLISH from Izv. Sibirsk. Otd. Akad. Nauk SSSR, Ser. Tekh. Nauk, no. 6, 1975 p 43-50
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The flow around two models in the form of cones, to whose rear endfaces a washer forming a ring projection over the conical surface to cause boundary layer separation is attached, was investigated in a pulsed hypersonic wind tunnel. The models were of steel, the roughness of the conical surface was less than 0.004 mm, the nose round-off diameter for all the tests was less than 0.05 mm. The purpose of the tests was to obtain data about the above-mentioned separation properties of the boundary layer and about whether the properties of the working process in the pulsed tunnel used will influence the test results. Author

N76-26157*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF REYNOLDS NUMBER ON THE SUBSONIC BOATTAIL DRAG OF SEVERAL WING-BODY CONFIGURATIONS
David E. Reubush Washington Jul. 1976 84 p refs
(NASA-TN-D-8238; L-10853) Avail: NTIS HC $5.00 CSCL 01A

An investigation was conducted in a transonic cryogenic tunnel to determine the effect of varying Reynolds number on the boattail drag of several wing-body configurations. This study was made at 0 deg angle of attack at Mach numbers from 0.6 to 0.9 for Reynolds numbers up to 67 x 1 million (based on distance from the nose to the start of the boattail). Results indicate that as the Reynolds number was increased the boattail static pressure coefficients in the expansion region of the boattail became more negative while those in the recompression region became more positive. Results show that there was only a small effect of Reynolds number of boattail pressure drag. Author

N76-26158# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
MISS DISTANCE CALCULATION FOR ROLLING MISSILES
J. Shinar and P. Zarchan Oct. 1975 55 p Sponsored by Israeli Ministry of Defense
(TAE-258) Avail: NTIS HC $4.50

Miss distance calculation of a rolling missile, guided by proportional navigation, is carried out by the adjoint method of analysis. To treat the case of a roll-coupled two-channel guidance system, an adjoint vector model is developed. This model leads, for constant roll rates, to a closed form solution, which can be applied asymptotically for very long guided flight times. Miss distances for time-varying roll rates or for short flight times are investigated by a digital simulation of the same mathematical model. Results show that for any given finite flight time, higher roll rates create increased miss distances, even if the roll-induced gain attenuation is compensated. For a periodic roll rate the miss distance depends on the phase at intercept; the amplitude of the deviations from the phase average value of the miss distance is frequency dependent. Author

N76-26159# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
DIVERGENCE RANGE OF HOMING MISSILES
J. Shinar [1976] 36 p refs Sponsored by Israeli Ministry of Defense
(TAE-266) Avail: NTIS HC $4.00

The results of an investigation of the detrimental effects of the roll-induced cross coupling on the divergence are presented. A new criterion for determining the divergence range in defined and the influence of several parameters on this range is shown. The correlation between the divergence range and the miss distance including the effect of limited missile maneuverability on this correlation are discussed. Author

N76-26160# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
A MODEL FOR THE EVALUATION OF INDUCED ROLLING MOMENT
J. Shinar, I. Gur, and J. Rom [1976] 46 p Sponsored by Israeli Ministry of Defense
(TAE-267) Avail: NTIS HC $4.00

Adverse rolling moments induced in canard controlled aerodynamic configurations make the roll control of such vehicles by the canard controls rather problematic. Experimental evidence shows that by careful aerodynamic design roll-controllable canard configurations can be achieved. A mathematical model is described to predict induced rolling moment in canard configurations. The method is used to evaluate the induced roll characteristics of canard missiles and is particularly useful for systematic design of roll controllable canard vehicles. The results obtained are compared to wind tunnel test data, showing a very good agreement at very small angles of incidence. At higher angles of incidence discrepancies are observed, indicating that the model should be improved by including the effects of the tail surfaces on the trajectories of the vortices. Author

N76-26161*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A VORTEX-LATTICE METHOD FOR THE MEAN CAMBER SHAPES OF TRIMMED NONCOPLANAR PLANFORMS WITH MINIMUM VORTEX DRAG
John E. Lamar Washington Jun. 1976 187 p refs
(NASA-TN-D-8090; L-10522) Avail: NTIS HC $7.50 CSCL 01A

A new subsonic method has been developed by which the mean camber surface can be determined for trimmed noncoplanar planforms with minimum vortex drag. This method uses a vortex lattice and overcomes previous difficulties with chord loading specification. A Trefftz plane analysis is utilized to determine the optimum span loading for minimum drag, then solved for the mean camber surface of the wing, which provides the required loading. Sensitivity studies, comparisons with other theories, and applications to configurations which include a tandem wing and a wing winglet combination have been made and are presented. Author

N76-26162*# Pratt and Whitney Aircraft, East Hartford, Conn.
ANALYSIS OF DISTORTION DATA FROM TF30-P-3 MIXED COMPRESSION INLET TEST Final Report
R. W. King, J. A. Schuerman, and R. G. Muller Washington Jun. 1976 160 p refs
(Contract NAS3-19076)
(NASA-CR-2686) Avail: NTIS HC $6.75 CSCL 01A

A program was conducted to reduce and analyze inlet and engine data obtained during testing of a TF30-P-3 engine operating behind a mixed compression inlet. Previously developed distortion analysis techniques were applied to the data to assist in the development of a new distortion methodology. Instantaneous distortion techniques were refined as part of the distortion methodology development. A technique for estimating maximum levels of instantaneous distortion from steady state and average turbulence data was also developed as part of the program. Author

N76-26163*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A DESIGN APPROACH AND SELECTED WIND TUNNEL RESULTS AT HIGH SUBSONIC SPEEDS FOR WING-TIP MOUNTED WINGLETS
Richard T. Whitcomb Washington Jul. 1976 32 p refs
(NASA-TN-D-8260; L-10908) Avail: NTIS HC $4.00 CSCL 01A

Winglets, which are small, nearly vertical, winglike surfaces, substantially reduce drag coefficients at lifting conditions. The primary winglet surfaces are rearward above the wing tips; secondary surfaces are forward below the wing tips. This report

presents a discussion of the considerations involved in the design of the winglets; measured effects of these surfaces on the aerodynamic forces, moments, and loads for a representative first generation, narrow body jet transport wing; and a comparison of these effects with those for a wing tip extension which results in approximately the same increase in bending moment at the wing-fuselage jucture as did the addition of the winglets. Author

N76-26164*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A HIGH SUBSONIC SPEED WIND TUNNEL INVESTIGATION OF WINGLETS ON A REPRESENTATIVE SECOND-GENERATION JET TRANSPORT WING
Stuart G. Flechner, Peter F. Jacobs, and Richard T. Whitcomb Washington Jul. 1976 67 p refs
(NASA-TN-D-8264; L-10387) Avail: NTIS HC $4.50 CSCL 01A

The effects of winglets on the aerodynamic forces and moments, loads, and crossflow velocities behind the wing tip are discussed. The results of the investigation indicate that winglets significantly reduce the drag coefficient at lifting conditions. The experiments were conducted in an 8-foot transonic pressure tunnel at Mach numbers from 0.70 to 0.83 and over a lift coefficient range up to 0.65. A semispan model was used.
Author

N76-26165*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
REVIEW OF DRAG CLEANUP TESTS IN LANGLEY FULL-SCALE TUNNEL (FROM 1935 TO 1945) APPLICABLE TO CURRENT GENERAL AVIATION AIRPLANES
Paul L. Coe, Jr. Washington Jun. 1976 99 p refs
(NASA-TN-D-8206; L-10735) Avail: NTIS HC $5.00 CSCL 01A

Results of drag cleanup tests conducted in the Langley full-scale tunnel during the period from 1935 to 1945 are summarized for potential application to current propeller-driven general aviation airplanes. Data from tests on 23 airplanes indicate that the drag increments produced by many individual configuration features - such as, power plant installation, air leakage, cockpit canopies, control surface gaps, and antenna installations - are not large; however, when the increments are summed, the resulting total drag increase is significant. On the basis of results of the investigation, it appears that considerable reduction in drag can be obtained by proper attention to details in aerodynamic design and by adherence to the guidelines discussed.
Author

N76-26166# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
GOLF BALL AERODYNAMICS
P. W. Bearman and J. K. Harvey Dec. 1975 31 p refs
(IC-Aero-75-12) Avail: NTIS HC $4.00

A wind tunnel technique was developed to measure the aerodynamic forces acting on golf balls over a wide range of Reynolds number and spin rate. Balls with round dimples and hexagonal dimples were investigated. The dimples are found to induce a critical Reynolds number behavior at a lower value of Reynolds number than that experienced by a smooth sphere and beyond this point, unlike a sand roughened sphere, there is little dependence of the forces on further increases in Reynolds number. A hexagonally dimpled ball has a high lift coefficient and a slightly lower drag coefficient than a conventional round dimpled ball. Trajectories are calculated using the aerodynamic data and the ranges are compared with data obtained from a driving machine on a golf course.
Author (ESA)

N76-26167# Naval Postgraduate School, Monterey, Calif.
SIMULTANEOUS IDENTIFICATION OF SHORT PERIOD AND PHUGOID STABILITY PARAMETERS USING AN ADVANCED LIKELIHOOD METHOD M.S. Thesis
Frederick T. Bryan Dec. 1975 119 p refs
(AD-A021760) Avail: NTIS CSCL 20/4

An investigation was conducted to determine the feasibility of obtaining the short period and phugoid stability derivatives from one maneuver, simultaneously. It was concluded that the maximum likelihood identification program SCIDNT I showed great promise in obtaining the short period and phugoid stability derivatives from one maneuver. Extraction of the short period stability parameters in the presence of the phugoid was easy, straight forward, and yielded results similar to those obtained from pure short period data. Estimation of the phugoid stability parameters was possible when they were estimated in conjunction with Zo, Xo, Mo, and Theta O. It was recommended that a new set of data be obtained at a flight condition where the phugoid is at least moderately damped and that this data be analyzed to resolve the present anomalies.
Author (GRA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N76-26168# National Aviation Facilities Experimental Center, Atlantic City, N.J.
MEASUREMENT OF TOXIC GASES AND SMOKE FROM AIRCRAFT CABIN INTERIOR MATERIALS USING THE NBS SMOKE CHAMBER AND COLORIMETRIC TUBES Final Report, Nov. 1974 - Jun. 1975
Constantine P. Sarkos Mar. 1976 62 p refs
(AD-A023413/8; FAA-NA-75-54; FAA-RD-76-7) Avail: NTIS HC $4.50 CSCL 01/2

Seventy-five self-extinguishing materials used in wide-bodied aircraft cabin interiors were tested in the National Bureau of Standards Smoke Chamber and analyzed for smoke and toxic gases in the combustion mixture. Concentrations of selected toxic gases were measured at regular intervals during the test, either directly from the chamber or from bag samples, using colorimetric detector tubes. Data analysis was facilitated by grouping the materials into usage designations and comparing the peak smoke and toxic gas concentrations. Despite the unknown magnitude of interference effects in the combustion mixture, detector tubes appear to offer a convenient and inexpensive method for identifying the presence of selected gases and approximating the relative gas yield of similar cabin materials.
Author

N76-26169# Optimum Computer Systems, Inc., Washington, D. C.
A STUDY OF ATTRITION IN THE DOMESTIC AVIATION FLEET Final Report
James K. Rocks 15 Jul. 1975 84 p
(Contract DOT-FA74WAI-496)
(AD-A023271/0; FAA-AVP-75-14) Avail: NTIS HC $5.00 CSCL 01/3

About 85 percent of the aircraft (a/c) added to the domestic fleet since 1947 are still registered. About 2 percent of the fleet is de-registered every year, but this average attrition rate is declining. Annual attrition, about 0.2 percent among new a/c, rises to 2.5 percent among a/c 15 to 20 years old and declines to 1 percent for older a/c. 30 percent of which are gone. Exports and imports of used a/c, accidents, irregularities and theft are negligible. About 10 percent of the registered fleet is inactive. Usage of single-engine a/c shifts from instructional and rental to business and personal as the a/c ages; multi-engine use is largely executive, business and air taxi. Attrition is largely a function of age; year-specific, type-specific and year-of-manufacture-specific rate differences are minor. A projection methodology employing a constructed, standard attrition rate, is developed and its use described.
Author

N76-26170# Arinc Research Corp., Annapolis, Md.
COST ANALYSIS OF AIRBORNE COLLISION AVOIDANCE SYSTEMS (CAS) CONCEPTS Final Report
Stanley Kowalski, J. Kent Haspert, and James Witt Dec. 1975 266 p
(Contract DOT-FA74WA-3506)
(AD-A023080/5; FAA-EM-76-1) Avail: NTIS HC $9.00 CSCL 01/2

The results of the cost and operational evaluations developed for three CAS Concepts: the Honeywell AVOIDS, the McDonnell

Douglas EROS, and the RCA SECANT were presented. To provide a basis for assessing the economic impact of CAS on the various aviation communities, separate cost evaluations have also been developed for general aviation, commercial aviation, and the military. The expected cost of ownership to the individual aircraft owner was presented as well as the cumulative life-cycle costs to the user communities, based on the competing manufacturers' data and independently developed electronics and installation cost data. Author

N76-26171*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOME EFFECTS OF ADVERSE WEATHER CONDITIONS ON PERFORMANCE OF AIRPLANE ANTISKID BRAKING SYSTEMS
Walter B. Horne, John L. McCarty, and John A. Tanner Washington Jul. 1976 32 p refs
(NASA-TN-D-8202; L-10690) Avail: NTIS HC $4.00 CSCL 01C

The performance of current antiskid braking systems operating under adverse weather conditions was analyzed in an effort to both identify the causes of locked-wheel skids which sometimes occur when the runway is slippery and to find possible solutions to this operational problem. This analysis was made possible by the quantitative test data provided by recently completed landing research programs using fully instrumented flight test airplanes and was further supported by tests performed at the Langley aircraft landing loads and traction facility. The antiskid system logic for brake control and for both touchdown and locked-wheel protection is described and its response behavior in adverse weather is discussed in detail with the aid of available data. The analysis indicates that the operational performance of the antiskid logic circuits is highly dependent upon wheel spin-up acceleration and can be adversely affected by certain pilot braking inputs when accelerations are low. Normal antiskid performance is assured if the tire-to-runway traction is sufficient to provide high wheel spin-up accelerations or if the system is provided a continuous, accurate ground speed reference. The design of antiskid systems is complicated by the necessity for tradeoffs between tire braking and cornering capabilities, both of which are necessary to provide safe operations in the presence of cross winds, particularly under slippery runway conditions. Author

N76-26172# South Carolina Aeronautics Commission, Columbia.
MARKETING AND POLICY STUDY OF COMMUTER AIRLINE SERVICE IN SOUTH CAROLINA Final Report
Aug. 1975 243 p refs Prepared in cooperation with Simat., Helliesen and Eichner, Inc., Newton Center, Mass.
(PB-249007/6; SCAC-001) Avail: NTIS HC $8.00 CSCL 01B

The opportunities are identified for improving the quality of air service provided in South Carolina through the development of an effective, efficient and economically viable system of commuter airline services. The socioeconomic trends of the state, its history of air transportation and the regulatory environment and operation characteristics of airlines serving light traffic density markets are analyzed. In summary it is concluded that a network of commuter air services in a number of South Carolina's short haul markets is feasible and will occur in the future. Accordingly, the development of commuter airline service in South Carolina should be an important objective of the state. GRA

N76-26173# National Transportation Safety Board, Washington, D.C.
ANNUAL REVIEW OF AIRCRAFT ACCIDENT DATA. US GENERAL AVIATION CALENDAR YEAR 1973
25 Jul. 1975 196 p
(PB-249559/6; NTSB-ARG-75-1) Avail: NTIS HC $7.50 CSCL 01B

A statistical compilation from reports of 4,255 general aviation accidents that occurred during calendar year 1973 is presented. Also included are 50 collisions between aircraft. By coding each aircraft involved in the collisions, an additional 50 records are produced, bringing total accident records to 4,305. GRA

N76-26174# Battelle Columbus Labs., Ohio.
IMPACTS OF POTENTIAL 1980'S AVIATION TECHNOLOGY ON THE CAPACITY OF AN EXISTING AIRPORT Final Report
Vincent J. Drago Mar. 1975 240 p refs
(Contract DOT-TSC-636)
(AD-A013920; TSC-FAA-AVP-75-1-Vol-2) Avail: NTIS CSCL 01/5

This study was conducted to determine the impacts which potential 1980's advances in aviation technology might have on the capacity and surrounding environment of a high-density air carrier airport. New York's La Guardia Airport was chosen to illustrate these impacts. Actual 1972 airport operations, and anticipated 1985 airport operations are examined. Four advanced technology development alternatives were identified for the mid to late 1980's time frame. A detailed airport configuration plan was derived for the development alternatives which had the highest potential passenger capacity. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications.*

N76-26175* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FAILURE DETECTION AND CONTROL MEANS FOR IMPROVED DRIFT PERFORMANCE OF A GIMBALLED PLATFORM SYSTEM Patent
Bernard J. OConner and Frank S. DeCarlo, inventors (to NASA) Issued 19 Jun. 1973 7 p Filed 12 Feb. 1971
(NASA-Case-MFS-23551-1; US-Patent-3,739,646; US-Patent-Appl-SN-114772; US-Patent-Class-74-5.34; US-Patent-Class-244-79) Avail: US Patent Office CSCL 17G

An invention relating to maintaining the drift performance of a gimballed platform, to detecting any excessive drift, and to controlling a suitable compensating system, was described. The invention utilizes two platforms, each having three skewed gyros, and thus provides maximum system accuracy with minimum platform redundancy. These platforms are coupled in redundant configuration, each of which is controlled by three single degree of freedom gyros. The six gyro input axes are skewed relative to an orthogonal triad and projections of one input axis on any other input axis are realized. A separate torquing signal is applied to the torque generators of each of three of the six gyros. Official Gazette of the U.S. Patent Office

N76-26176*# Ohio Univ., Athens. Avionics Engineering Center.
SMALL-AIRCRAFT FLIGHT EVALUATION OF RUSTRAK CHART RECORDER
Richard J. Salter, Jr. and Robert W. Lilley May 1976 7 p
(Grant NGR-36-009-017)
(NASA-CR-148147; TM-28) Avail: NTIS HC $3.50 CSCL 17G

It was found that the RUSTRAK recorder was only slightly hampered by aircraft vibration while in level cruising flight or while taxiing, regardless of light turbulence or particular mounting configuration. No one mounting configuration was better than the other. There is some (approximately 1/4 inch) vibration error during climbs, descents, and touchdowns in choppy weather. However, it was found that improved performance resulted from setting the recorder on carpet rather than the metal floor plate. This suggests that padding the recorder with some cushioning, shock-damping material might reduce the engine vibration and wind chop effects. Author

N76-26177# Lincoln Lab., Mass. Inst. of Tech., Lexington.
DEVELOPMENT OF A DISCRETE ADDRESS BEACON SYSTEM Quarterly Technical Summary Report 1 Oct. - 31 Dec. 1975
1 Jan. 1976 58 p refs Sponsored by AF

(Contract DOT-FA72WAI-261)
(AD-A023065/6; FAA-RD-76-10) Avail: NTIS HC $4.50 CSCL 17/7

A technical summary report of the work completed on the Discrete Address Beacon System (DABS) during the period 1 October through 31 December 1975 was presented. The following information is included: latest results of analytical studies, laboratory and flight experiments, and software developments supporting the concept feasibility and performance definition phase of the DABS program. Author

N76-26178# National Aviation Facilities Experimental Center, Atlantic City, N.J.
AREA NAVIGATION HIGH-ALTITUDE NETWORK STUDY Final Report, Sep. 1973 - Jun. 1974
Arthur G. Halverson, Floyd B. Woodson, Richard W. Soper, and Henry L. Arch Feb. 1976 304 p refs
(FAA-NA-75-41; FAA-RD-76-6) Avail: NTIS HC $9.75 CSCL 17/7

Route structures were evaluated through fast time simulation of a mixed RNAV/VOR environment, with traffic samples representing projected traffic densities for the pre-1977, 1977-1982, and post-1982 time periods with varying mixes of RNAV-equipped aircraft. Alternative route structure design principles were developed which differed from the RNAV Task Force concepts in: (1) the configuration of arrival and departure routing into and out of terminal areas; (2) the use of one-way routes; (3) the use of charted routes versus provision for noncharted offset tracks; (4) the treatment given to traffic from intermediate terminals with respect to nearby flows between more distant terminals; and (5) route width requirements. Results indicate that RNAV offers a potential reduction in workload for the enroute air traffic controller. Author

N76-26179# Arinc Research Corp., Annapolis, Md.
COST ANALYSIS OF THE AIRBORNE PORTION OF DISCRETE ADDRESS BEACON SYSTEM INTERMITTENT POSITIVE CONTROL (DABS/IPC) CONCEPT Final Report
Stanley Kowalski, J. K. Haspert, and James Witt Dec. 1975 249 p
(Contract DOT-FA74WA-3506)
(AD-A023538/2; FAA-EM-76-2) Avail: NTIS HC $8.00 CSCL 17/7

The results of the cost and reliability evaluations developed for discrete and LSI versions of the airborne portion of the DABS/IPC concept were presented. To provide a basis for assessing the economic impact of DABS on the various aviation communities, separate cost evaluations have been developed for general aviation, commercial aviation, and the military. The expected cost of ownership to the individual aircraft owner was presented as well as the cumulative life-cycle cost to the user communities, based on the developed data. Author

N76-26180*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MAGNETIC HEADING REFERENCE Patent Application
Howell D. Garner, inventor (to NASA) Filed 16 Oct. 1975 25 p
(NASA-Case-LAR-11387-2; US-Patent-Appl-SN-623156) Avail: NTIS HC $3.50 CSCL 17G

A patent application for an invention related to a magnetometer used as a magnetic heading reference for a vehicle such as a small aircraft was presented. The magnetometer is mounted on a directional dial in the aircraft in the vicinity of the pilot such that it is free to turn with the dial about the yaw axis of the aircraft. The invention includes a circuit for generating a signal proportional to the northerly turning error produced in the magnetometer due to the vertical component of the earth's magnetic field. This generated signal is then subtracted from the output of the magnetometer to compensate for the northerly turning error. NASA

N76-26181# Proteon Associates, Inc., Waltham, Mass.
PHASE DERIVED NAVIGATION STUDIES Final Report, Nov. 1974 - Sep. 1975
Howard Salwen and Southard Lippincott 30 Sep. 1975 123 p refs
(Contract F19678-75-C-0087; AF Proj. 8682)
(AD-A019688; AFCRL-TR-75-0526) Avail: NTIS CSCL 17/7

The design of an aircraft landing system which provides a perspective display to the pilot is considered. Potential sources of error are evaluated. Data reduction schemes are discussed and evaluated. Candidate hardware implementation techniques are presented. In addition, the results of an experiment to determine the magnitudes of the sources of error to be encountered in such systems are presented. GRA

N76-26182# Naval Electronics Lab. Center, San Diego, Calif.
OMEGA FORMAT OPTIMIZATION
E. R. Swanson, J. E. Britt, J. J. Wilson, and J. C. Hanselman 8 Oct. 1975 30 p refs
(AD-A019364; NELC-TR-1966) Avail: NTIS CSCL 17/7

A history of considerations leading to the present recommended Omega transmission format is presented. Alternative formats are discussed. It is suggested that serious consideration be given to addition of a fourth commutated Omega transmission with corresponding deletion of transmissions at the second unique frequency. The impact of such an implementation is discussed; engineering details are outlined in appendices. GRA

N76-26183# IBM Federal Systems Div., Owego, N.Y.
AUTONOMOUS NAVIGATION TECHNOLOGY PHASE 1B: ILT FLIGHT TEST MODEL RECEIVER DESIGN Final Report, Oct. 1974 - Nov. 1975
Douglas H. Aldrich, Lynn O. Smith, and Michael Rushanski 1 Nov. 1975 124 p refs
(Contract F04701-75-C-0046; AF Proj. 681D)
(AD-A019414; IBM-75-L74-004ANT; SAMSO-TR-75-298) Avail: NTIS CSCL 17/7

A detailed design of the receiver portion of a flight test model Interferometric Landmark Tracker (ILT) was completed. Prototype RF subassemblies and breadboard circuits were built and tested. Test results indicate the flight test model ILT receiver will provide an accuracy of 0.57 phase one sigma over the frequency range of 2.5 to 2.9 GHz, the specified temperature range of 30 F to +160 F and the received signal dynamic range of 50 db. Author (GRA)

N76-26184# Naval Postgraduate School, Monterey, Calif.
THE APPLICATION OF EXTENDED KALMAN FILTERING TO THE POSITION LOCATING REPORTING SYSTEM (PLRS) M.S. Thesis
Charles A. Dittmar, Jr. Dec. 1975 81 p ref
(AD-A021855; NPS-52TS75121) Avail: NTIS CSCL 17/3

Extended Kalman filtering is applied to the PLRS (Position Locating Reporting System). Here the nonlinearity to the filter enters through the measurement (range only). The nonlinearity being the relationship between range and the Cartesian coordinate states of the filter. Filter covariances of error are portrayed as error ellipsoids. These are used to determine which one should be used to update a unit when there are several other units available for ranging. One should attempt to make the range measurement in the same direction as the major axis of error associated with the unit to be updated. The filtering techniques are evaluated using static units and high speed maneuvering aircraft. Author (GRA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*

N76-26185*# Kanner (Leo) Associates, Redwood City, Calif.
THE M-15 AIRCRAFT IN THE AIR
R. Nemets Washington NASA Jun. 1976 9 p Transl. into ENGLISH from Pol'sha (Poland), v. 253, no. 9, 1975 p 4-7
(Contract NASw-2790)
(NASA-TT-F-17066) Avail: NTIS HC $3.50 CSCL 01C

Names, personal impressions and thoughts of some of the participants in the development and building of the M-15

agricultural aircraft are given. Illustrations that describe a light jet biplane are included. The time sequence of the development is presented. Author

N76-26186*# Kanner (Leo) Associates, Redwood City, Calif.
COMPARISON OF WIND TUNNEL TESTS AND FLIGHT TESTS ON AN EXECUTIVE AIRCRAFT
Washington NASA Jun. 1976 23 p Transl. into ENGLISH from Assoc. Aeronautique Astronautique de France (Paris), no. AAAF-NT-75-14, 1975 24 p
(Contract NASw-2790)
(NASA-TT-F-17068; AAAF-NT-75-14) Avail: NTIS HC $3.50 CSCL 01C

Wind tunnel tests and flight tests on a business aircraft are compared. The direct method involves comparing the unitary curves obtained from the two tests, whereas the indirect method consists of establishing from the wind tunnel tests a basic set of adjusted parameters that are converted into the same time based parameters recorded on flight test tapes, using flight mechanics equations and a simulation program. Results of longitudinal and lateral tests are discussed. Author

N76-26187*# Purdue Univ., Lafayette, Ind.
A UNIQUE FORMULATION OF ELASTIC AIRPLANE LONGITUDINAL EQUATIONS OF MOTION
Robert L. Swaim and Donald G. Fullman [1976] 25 p refs
(Grant NsG-4003)
(NASA-CR-148205) Avail: NTIS HC $3.50 CSCL 01C

Control-configured vehicle technology has increased the demand for detailed analysis of dynamic stability and control, handling and ride qualities, and control system dynamics at early stages of preliminary design. An approximate, but reasonably accurate, set of equations of motion are needed for these early analyses. Such a formulation is developed for the longitudinal dynamics of elastic airplanes. It makes use of only rigid-body aerodynamic stability derivatives in formulating the forces and moments due to elastic motion. Verification of accuracy using data for the B-1 airplane shows very good agreement. Frequencies and damping ratios of the coupled modes corresponding to complex roots of the characteristic equations agree closely with four symmetric elastic modes included. Author

N76-26188*# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
LATERAL RIDE QUALITY OF THE B-1 AIRCRAFT SUBJECTED TO A REDUCTION OF LATERAL STATIC STABILITY
Andrew J. Hinsdale 10 Apr. 1976 16 p refs Presented at 1976 AIAA Midwest Student Conf., Milwaukee, 8-10 Apr. 1976
(Grant NsG-4003)
(NASA-CR-148206) Avail: NTIS HC $3.50 CSCL 01C

A method to evaluate the lateral ride quality of a B-1 aircraft subjected to a reduction in lateral static stability is developed. Ride quality is then found for three different relaxed static stability configurations which are augmented by yaw rate feedback to restore specified handling qualities. These cases are compared to the ride quality of the unrelaxed aircraft with the same handling qualities. Author

N76-26189*# Purdue Univ., Lafayette, Ind. School of Aeronautics and Astronautics.
RIDE QUALITY SENSITIVITY TO SAS CONTROL LAW AND TO HANDLING QUALITY VARIATIONS
Philip A. Roberts, David K. Schmidt, and Robert L. Swaim [1976] 14 p refs
(Grant NsG-4003)
(NASA-CR-148207) Avail: NTIS HC $3.50 CSCL 01C

The RQ trends which large flexible aircraft exhibit under various parameterizations of control laws and handling qualities are discussed. A summary of the assumptions and solution technique, a control law parameterization review, a discussion of ride sensitivity to handling qualities, and the RQ effects generated by implementing relaxed static stability configurations are included. Author

N76-26190*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HIGH-ATTITUDE LOW-SPEED STATIC AERODYNAMIC CHARACTERISTICS OF AN F-4D FIGHTER AIRPLANE MODEL WITH LEADING EDGE SLATS
James C. Monfort and W. Morrow Whitcomb Aug. 1975 158 p refs
(NASA-TM-X-62355; A-5552) Avail: NTIS HC $6.75 CSCL 01C

An investigation was conducted to determine the effects of two-position leading edge slats on the low speed aerodynamic characteristics of a swept wing twin-jet supersonic fighter airplane model at high angle of attack and various Reynolds numbers. The investigation was performed at a Mach number of 0.20 over a range of angle of attack from 19 deg to 90 deg and angles of slideslip from -10 deg to 30 deg and Reynolds numbers from 1.97 to 13.12 million per meter. Author

N76-26191*# Virginia Polytechnic Inst. and State Univ., Blacksburg.
STRUCTURAL DYNAMICS, STABILITY, AND CONTROL OF HELICOPTERS Semiannual Technical Progress Report, 1 Nov. 1975 - 31 May. 1976
Leonard Meirovitch, L. Glenn Kraige, and Arthur L. Hale Jun. 1976 97 p refs
(Grant NsG-1114)
(NASA-CR-148286; SAPR-3) Avail: NTIS HC $5.00 CSCL 01C

The dynamic synthesis of a helicopter is reported. The method of approach is a variation of the component mode synthesis in the sense that it regards the aircraft as an assemblage of interconnected substructures. The equations of motion are derived in general form by means of the Lagrangian formulation in conjunction with an orderly kinematical procedure that takes into account the superposition of motion of various substructures, thus circumventing constraint problems. Author

N76-26192# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
ANALYSIS OF OPTIMAL EVASIVE MANEUVERS BASED ON A LINEARIZED TWO-DIMENSIONAL KINEMATIC MODEL
J. Shinar and D. Steinberg Nov. 1975 59 p refs
(TAE-230) Avail: NTIS HC $4.50

Optimal evasion from proportionally guided missiles is analyzed assuming two-dimensional linearized kinematics. Due to the simplicity of the approach it is possible to include in the mathematical model factors which have been neglected in other analytic studies. It is demonstrated that these factors such as: the exact dynamic structure of the guidance system, the location of the saturating element in the guidance loop, the limited roll rate of the evading aircraft, etc., have major effects on the optimal maneuver sequence and determine the order of magnitude of the resulting miss distance. Comparison with studies, which used nonlinear kinematic models, shows that the domains of validity of linearized kinematics and two-dimensional analysis coincide. In the case of optimal evasion assessment, both assumptions are limited in their validity to nearly head-on or tail chase engagements. To analyze engagements of other initial conditions a three-dimensional model is required. The method described can be extended for this type of three-dimensional study. Author

N76-26193*# Grumman Aerospace Corp., Bethpage, N.Y.
VALIDATION OF SCRAMJET EXHAUST SIMULATION TECHNIQUE Final Report
H. B. Hopkins, W. Konopka, and J. Leng Washington Jun. 1976 85 p refs
(Contract NAS1-13089)
(NASA-CR-2688; RE-509) Avail: NTIS HC $5.00 CSCL 01C

Scramjet/airframe integration design philosophy for hypersonic aircraft results in configurations having lower aft surfaces that serve as exhaust nozzles. There is a strong coupling between the exhaust plume and the aerodynamics of the vehicle, making accurate simulation of the engine exhaust mandatory. The experimental verification of the simulation procedure is described. The detonation tube simulator was used to produce an exact simulation of the scramjet exhaust for a Mach 8 flight condition. The pressure distributions produced by the exact exhaust flow were then duplicated by a cool mixture Argon and Freon 13B1. Such a substitute gas mixture validated by the detonation tube technique could be used in conventional wind tunnel tests. The

results presented show the substitute gas simulation technique to be valid for shockless expansions. Author

N76-26194*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPARISON OF A LINEAR AND A NONLINEAR WASHOUT FOR MOTION SIMULATORS UTILIZING OBJECTIVE AND SUBJECTIVE DATA FROM CTOL TRANSPORT LANDING APPROACHES
Russell V. Parrish and Dennis J. Martin, Jr. Washington Jun. 1976 83 p refs
(NASA-TN-D-8157; L-10593) Avail: NTIS HC $5.00 CSCL 01C

Objective and subjective data gathered in the processes of comparing a linear and a nonlinear washout for motion simulators reveal that there is no difference in the pilot performance measurements used during instrument landing system (ILS) approaches with a Boeing 737 conventional takeoff and landing (CTOL) airplane between fixed base, linear washout, and nonlinear washout operations. However, the subjective opinions of the pilots reveal an important advance in motion cue presentation. The advance is not in the increased cue available over a linear filter for the same amount of motion base travel but rather in the elimination of false rotational rate cues presented by linear filters. Author

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-26195*# Pratt and Whitney Aircraft, East Hartford, Conn.
TWO-STAGE, LOW NOISE ADVANCED TECHNOLOGY FAN. VOLUME 2: AERODYNAMIC DATA
K. G. Harley and P. A. Odegard Sep. 1975 366 p refs
(Contract NAS3-16811)
(NASA-CR-134828; PWA-5258-Vol-2) Avail: NTIS HC $10.50 CSCL 21E

Aerodynamic data from static tests of a two-stage advanced technology fan designed to minimize noise are presented. Fan design conditions include delivery of 209.1kg/sec/sq m (42. 85 lbm/sec/sq ft) specific corrected flow at an overall pressure ratio of 1.9 and an adiabatic efficiency of 85.3 percent. The 0.836m (2.74ft) diameter first stage rotor has a hub/tip ratio of 0.4 and 365.8m/sec (1200ft/sec) design tip speed. In addition to the moderate tip speed and pressure rise per stage, other noise control design features involve widely spaced blade rows and proper selection of blade-vane ratios. Aerodynamic data are presented for tests with unifrom and with hub and tip radially distorted inlet flow. Aerodynamic data are also presented for tests of this fan with acoustic treatments, including acoustically treated casing walls, a flowpath exit acoustic ring, and a translating centerbody sonic inlet device. A complete tabulation of the overall performance data, the blade element data, and the power spectral density information relating to turbulence levels generated by the sonic inlet obtained during these tests is included. For vol. 1, see N74-33789. Author

N76-26196*# Pratt and Whitney Aircraft, East Hartford, Conn.
TWO-STAGE, LOW NOISE ADVANCED TECHNOLOGY FAN. VOLUME 3: ACOUSTIC DATA
T. G. Sofrin and N. Riloff, Jr. Sep. 1975 316 p refs
(Contract NAS3-16811)
(NASA-CR-134829; PWA-5303-Vol-3) Avail: NTIS HC $9.75 CSCL 21E

Tabulations and plots of the principal farfield noise characteristics of the fan installed in a special outdoor static noise test facility are presented. Author

N76-26197*# Pratt and Whitney Aircraft, East Hartford, Conn.
TWO-STAGE, LOW NOISE ADVANCED TECHNOLOGY FAN. 4: AERODYNAMIC FINAL REPORT
K. G. Harley and M. J. Keenan Sep. 1975 177 p refs
(Contract NAS3-16811)
(NASA-CR-134830; PWA-5304) Avail: NTIS HC $7.50 CSCL 21E

A two-stage research fan was tested to provide technology for designing a turbofan engine for an advanced, long range commercial transport having a cruise Mach number of 0.85 -0.9 and a noise level 20 EPNdB below current requirements. The fan design tip speed was 365.8m/sec (1200ft/sec);the hub/tip ratio was 0.4; the design pressure ratio was 1.9; and the design specific flow was 209.2 kg/sec/sq m(42.85lbm/sec/sq ft). Two fan-versions were tested: a baseline configuration, and an acoustically treated configuration with a sonic inlet device. The baseline version was tested with uniform inlet flow and with tip-radial and hub-radial inlet flow distortions. The baseline fan with uniform inlet flow attained an efficiency of 86.4% at design speed, but the stall margin was low. Tip-radial distortion increased stall margin 4 percentage points at design speed and reduced peak efficiency one percentage point. Hub-radial distortion decreased stall margin 4 percentage points at all speeds and reduced peak efficiency at design speed 8 percentage points. At design speed, the sonic inlet in the cruise position reduced stall margin one percentage point and efficiency 1.5 to 4.5 percentage points. The sonic inlet in the approach position reduced stall margin 2 percentage points. Author

N76-26198*# Pratt and Whitney Aircraft, East Hartford, Conn.
TWO-STAGE, LOW NOISE ADVANCED TECHNOLOGY FAN. 5: ACOUSTIC FINAL REPORT
T. G. Sofrin and N. Riloff, Jr. Sep. 1975 115 p refs
(Contract NAS3-16811)
(NASA-CR-134831; PWA-5305) Avail: NTIS HC $5.50 CSCL 21E

The NASA Q2S(quiet two-stage) fan is a 0.836m (32.9 in.) diameter model of the STF 433 engine fan, selected in a 1972 study for an Advanced Technology Transport (ATT) airplane. Noise-control features include: low tip speed, moderate stage pressure rise, large blade-vane spacings, no inlet guide vanes, and optimum blade and vane numbers. Tests were run on the baseline Q2S fan with standard inlet and discharge ducts. Further tests were made of a translating centerbody sonic inlet device and treated discharge ducts. Results were scaled to JT8D and JT3D engine fan size for comparison with current two-stage fans, and were also scaled to STF 433 fan size to compare calculated ATT flyover noise with FAR 36 limits. Baseline Q2S results scaled to JT8D and JT3D engine fan sizes showed substantial noise reductions. Calculated unsuppressed baseline ATT flyovers averaged about 2.5 EPNdB below FAR 36 limits. Using measured sonic inlet results, scaled baseline Q2S fan results, and calculated attenuations for a 1975 technology duct liner, projected flyover noise calculations for the ATT averaged about FAR 36 limits minus 10 EPNdB. Advances in suppression technology required to meet the 1985 goal of FAR 36 limits minus 20 EPNdB are discussed. Author

N76-26199*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE NASA POLLUTION-REDUCTION TECHNOLOGY PROGRAM FOR SMALL JET AIRCRAFT ENGINES Status Report
James S. Fear 1976 19 p refs Presented at the 12th Propulsion Conf., Palo Alto, Calif., 26-29 Jul. 1976; sponsored by AIAA and Soc. of Automotive Engr.
(NASA-TM-X-73419; E-8757) Avail: NTIS HC $3.50 CSCL 21E

Three advanced combustor concepts, designed for the AiResearch TFE 731-2 turbofan engine, were evaluated in screening tests. Goals for carbon monoxide and unburned hydrocarbons were met or closely approached with two of the concepts with relatively modest departures from conventional combustor design practices. A more advanced premixing/prevaporizing combustor, while appearing to have the potential for meeting the oxides of nitrogen goal as well, will require extensive development to make it a practical combustion system. Smoke numbers for the two combustor concepts were well within the EPA smoke standard. Phase 2, Combustor-Engine Compatibility Testing, which is in its early stages, and planned Phase 3, Combustor-Engine Demonstration Testing, are also described. Author

N76-26200*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.

SONIC BOOM RESULTS FOR A NOMINAL MISSION 3B. SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT, ENGINEERING SYSTEMS ANALYSIS

10 Jun. 1975 16 p refs

(Contract NAS9-13970)

(NASA-CR-147769; Rept-1.2-DN-B0205-08) Avail: NTIS HC $3.50 CSCL 20A

The results obtained in the analysis of the effects of sonic boom overpressures at ground level for a nominal Mission 3B with the current baseline guidance are reported. These results are in the form of ground level overpressures generated along the groundtrack out to lateral cutoff from Mach 3.0-1.10 at 0.10 (tenth) Mach intervals. Preliminary trajectory constraints which will reduce excess sonic boom overpressures to approximately 2.0 PSF are included. Author

N76-26201*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

AN IMPROVED TURBINE DISK DESIGN TO INCREASE RELIABILITY OF AIRCRAFT JET ENGINES

W. N. Barack and P. A. Domas Jul. 1976 142 p refs

(Contract NAS3-18564)

(NASA-CR-135033; R76AEG324) Avail: NTIS HC $6.00 CSCL 21E

An analytical study was performed on a novel disk design to replace the existing high-pressure turbine, stage 1 disk on the CF6-50 turbofan engine. Preliminary studies were conducted on seven candidate disk design concepts. An integral multidisk design with bore entry of the turbine blade cooling air was selected as the improved disk design. This disk has the unique feature of being redundant such that if one portion of the disk would fail, the remaining portion would prevent the release of large disk fragments from the turbine system. Low cycle fatigue lives, initial defect propagation lives, burst speed, and the kinetic energies of probable disk fragment configurations were calculated, and comparisons were made with the existing disk, both in its current material, IN 718, and with the substitution of an advanced alloy, Rene 95. The design for redundancy approach which necessitated the addition of approximately 44.5 kg (98 lb) to the design disk substantially improved the life of the disk. The life to crack initiation was increased from 30,000 cycles to more than 100,000 cycles. The cycles to failure from initial defect propagation were increased from 380 cycles to 1564 cycles. Burst speed was increased from 126 percent overspeed to 149 percent overspeed. Additionally, the maximum fragment energies associated with a failure were decreased by an order of magnitude. Author

N76-26202*# Boeing Commercial Airplane Co., Seattle, Wash.

FLIGHT EFFECTS ON NOISE GENERATED BY THE JT8D-17 ENGINE IN A QUIET NACELLE AND A CONVENTIONAL NACELLE AS MEASURED IN THE NASA-AMES 40- BY 80-FOOT WIND TUNNEL

Frank G. Strout Washington Jun. 1976 101 p refs

(Contract NAS2-8213)

(NASA-CR-2576; D6-42813-1) Avail: NTIS HC $5.50 CSCL 21E

A JT8D-17 turbofan engine was tested in the NASA-Ames 40- by 80-foot wind tunnel to determine flight effects on jet and fan noise. Baseline, quiet nacelle with 20-lobe ejector/suppressor, and internal mixer configurations were tested over a range of engine power settings and tunnel velocities. Flight effects derived from the 40- by 80-foot wind tunnel test are compared with 727/JT8D flight test data and with model data obtained in a smaller wind tunnel. Procedures are defined for measuring noise data in a wind tunnel relatively near the sources and analyzing the results to obtain far-field flight effects. Wind tunnel and 727 flight test noise results compare favorably for both the baseline and quiet nacelle configurations. Two reports are provided, including a comprehensive version with extensive test results and analysis and the subject summary version that emphasizes data analysis and program finding. Author

N76-26203*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANALYSIS OF EXPERIMENTAL RESULTS OF THE INLET FOR THE NASA HYPERSONIC RESEARCH ENGINE AEROTHERMODYNAMIC INTEGRATION MODEL

Earl H. Andrews, Jr. and Ernest A. Mackley Washington Jun. 1976 50 p refs

(NASA-TM-X-3365; L-10400) Avail: NTIS HC $4.00 CSCL 21E

An aerodynamic engine inlet analysis was performed on the experimental results obtained at nominal Mach numbers of 5, 6, and 7 from the NASA Hypersonic Research Engine (HRE) Aerothermodynamic Integration Model (AIM). Incorporation on the AIM of the mixed-compression inlet design represented the final phase of an inlet development program of the HRE Project. The purpose of this analysis was to compare the AIM inlet experimental results with theoretical results. Experimental performance was based on measured surface pressures used in a one-dimensional force-momentum theorem. Results of the analysis indicate that surface static-pressure measurements agree reasonably well with theoretical predictions except in the regions where the theory predicts large pressure discontinuities. Experimental and theoretical results both based on the one-dimensional force-momentum theorem yielded inlet performance parameters as functions of Mach number that exhibited reasonable agreement. Previous predictions of inlet unstart that resulted from pressure disturbances created by fuel injection and combustion appeared to be pessimistic. Author

N76-26204# ARO, Inc., Arnold Air Force Station, Tenn.

A COMPUTER MODEL FOR THE CALCULATION OF THERMODYNAMIC PROPERTIES OF WORKING FLUIDS OF A GAS TURBINE ENGINE Final Report, 31 Jul. 1972 - 30 Jun. 1974

John M. Pelton AEDC Mar. 1976 87 p refs

(AD-A021859; ARO-ETF-TR-75-92; AEDC-TR-76-15) Avail: NTIS CSCL 21/5

A computer model is presented for the calculation of the thermodynamic properties of air and the exhaust gas from a gas turbine. The model was developed specifically to include the requirements for on-line data reduction systems. These requirements include minimum memory and calculation time and constituents and their thermodynamic properties that may be readily located and altered if necessary. The model is based on air and hydrocarbon fuels and includes real gas effects (intermolecular forces and chemical dissociation). Eqautions for the thermodynamic properties of the constituents of air and exhaust gas are included. Calculated data from this program are compared with data from sources currently in use in the gas turbine industry. Author (GRA)

N76-26205# Bari Univ. (Italy). Ist. di Macchine.

BEHAVIOR SIMULATION OF SINGLE CYLINDER DISCHARGE DUCTS [SIMULAZIONE DEL COMPORTAMENTO DEI CONDOTTI DI SCARICO DI UN MONOCILINDRO]

Andrea Dadone Jul. 1974 40 p refs In ITALIAN

Avail: NTIS HC $4.00

A model of a unicylinder alternating engine with straight discharge ducts with open end or a nozzle is presented which simulates an axial supercharging turbine. The boundary conditions are discussed and integrating methods taken from other types of applications are suggested. A computation procedure is given which shows fair agreement with results taken from the literature. ESA

N76-26206# Acurex Corp., Mountain View, Calif.
TURBINE ENGINE TELEMETRY ANALYSIS Final Report, 30 Apr. - 1 Nov. 1975
Alan J. Adler Nov. 1975 68 p refs
(Contract F33615-75-C-2055; AF Proj. 3066)
(AD-A019862; AFAPL-TR-75-95) Avail: NTIS CSCL 21/5

Turbine engine telemetry (miniature radio transmitters, mounted on rotating engine components to telemeter physical measurement data) were analyzed with the goals of achieving standardization, reduced costs and higher operating temperature. The report contains: the results of a telemetry-user survey and recommended standards for both packaging and function; and, results of a brief exploration of the problems associated with operating microelectronic circuitry at temperatures up to 200C, including 200C functional test data on 18 typical microelectronic components. GRA

N76-26207# Sikorsky Aircraft, Stratford, Conn. Sikorsky Aircraft Div.
ROTOR BROADBAND NOISE RESULTING FROM TIP VORTEX/BLADE INTERACTION Final Report, Jun. 1972 - Dec. 1974
Charles L. Munch, Robert W. Patterson, and Henry Day Feb. 1975 97 p refs
(Contract DAHC04-72-C-0040)
(AD-A020692; SER-50909) Avail: NTIS CSCL 01/3

The study described was conducted to investigate tip vortex/blade interaction as a source of broadband noise to hovering helicopter rotors. Observations of full scale, multi-blade rotors indicate that at moderate to high lift conditions the tip vortex, passing beneath a blade caused a stall pocket to form near the blade tip. At these same lift conditions rotor noise (expressed as Perceived Noise Level) was observed to increase at a faster rate than for lower lift conditions. This behavior has been termed 'noise divergence.' An experimental investigation was conducted in the UARL Acoustic Research Wind Tunnel to define the noise characteristics associated with this tip vortex/blade interaction. GRA

N76-26208 Advisory Group for Aerospace Research and Development, Paris (France).
MODERN PREDICTION METHODS FOR TURBOMACHINE PERFORMANCE
Jun. 1976 164 p refs Presented as a lecture series at Munich, 14-15 Jun. 1976 and London, 17-18 Jun. 1976
(AGARD-LS-83) Copyright. Avail: NTIS HC $6.75

The opening remarks are presented of a lecture series in which techniques for the prediction of turbomachine performance prediction were discussed. The topics covered in the series were: propulsion and flight system simulation; compressor and turbine performance prediction systems; design selection and optimization of axial-flow fan and compressor units for engine application; computation of turbomachine flow fields; and, advanced propulsion system development. A.S.K.

N76-26209 Motoren- und Turbinen-Union Muenchen G.m.b.H. (West Germany).
AIRCRAFT GAS TURBINE CYCLE PROGRAMS: REQUIREMENTS FOR COMPRESSOR AND TURBINE PERFORMANCE PREDICTION
K. Bauerfeind *In* AGARD Mod. Prediction Methods for Turbomachine Performance Jun. 1976 12 p (For availability see N76-26208 17-07)

Typical design applications for an engine performance program are shown. A characteristic structure is presented of a thermodynamic engine model for steady state performance prediction. A technique for determining nondimensional engine performance is derived from non-dimensional component performance. Compressor and turbine characteristics are also discussed. A.S.K.

N76-26210 Iowa State Univ. of Science and Technology, Ames.
COMPRESSOR AND TURBINE PERFORMANCE PREDICTION SYSTEM DEVELOPMENT: LESSONS FROM THIRTY YEARS OF HISTORY
George K. Serovy *In* AGARD Mod. Prediction Methods for Turbomachine Performance Jun. 1976 19 p refs (For availability see N76-26208 17-07)

Methods are reviewed for prediction of aerodynamic performance of aircraft propulsion system turbomachinery configurations. Progress is traced in the two classes of methods which can predict only overall performance characteristics or maps. These methods were conceived at least thirty years ago and are not only used, but continue to be the subject of research today. Prediction methods which include flow field definition in the blade passages of compressors and turbines are described. Author

N76-26211 Rolls-Royce Ltd., Derby (England). Compressor Research Dept.
AXIAL FLOW COMPRESSOR PERFORMANCE PREDICTION
R. A. Wall *In* AGARD Mod. Prediction Methods for Turbomachine Performance Jun. 1976 34 p (For availability see N76-26208 17-07)

Owing to the nature of axial flow compressors, performance prediction is characteristically difficult to achieve by theoretical analysis, and therefore recourse to gross empiricism, laced with theory, is fundamental to methods employed. Factors determining the performance requirements of compressors, and the physical mechanisms which control their ability to satisfy these requirements, are discussed to expose the nature of compressors. Compressor design optimization is described to illustrate how effective compromise can be achieved between design point performance and various off-design excursions demanded by turbomachine performance. Typical performance prediction methods which reflect the nature of compressors and quantify their performance characteristics, are described with some reference to the influence of engine environmental factors. Potential developments are discussed which could influence the type of design employed in future engines. Author

N76-26212 Dynatech R/D Co., Cambridge, Mass. Engineering Mechanics Dept.
FLOW FIELD AND PERFORMANCE MAP COMPUTATION FOR AXIAL-FLOW COMPRESSORS AND TURBINES
Richard A. Novak *In* AGARD Mod. Prediction Methods for Turbomachine Performance Jun. 1976 27 p refs (For availability see N76-26208 17-07)

The current research emphasis on two-dimensional computing schemes, and upon the compressor rather than on the turbine, is not the result of bias. Currently, rapid progress is being made on the implementation of quasi-three-dimensional techniques. Computing techniques whose objective is to define the detailed flow field within a blade row are described. The problems associated with axisymmetric performance computation for the axial turbine are also discussed. The discussion and development of the system is in the context of axial compressors. Author

N76-26213 Creare, Inc., Hanover, N.H. Fluids/Thermal Engineering Div.
DESIGN OPTIMIZATION AND PERFORMANCE MAP PREDICTION FOR CENTRIFUGAL COMPRESSORS AND RADIAL INFLOW TURBINES
David Japikse *In* AGARD Mod. Prediction Methods for Turbomachine Performance Jun. 1976 15 p refs (For availability see N76-26208 17-07)

The initial specification of compressor and turbine geometry and performance characteristics, including operating maps, can follow different paths depending on the degree of departure from previous design experience. Principal attention is focused on totally new design problems requiring systematic design optimization to meet performance criteria under diverse operating conditions. The fundamental flow physics involved for both the centrifugal compressor and radial inflow turbine are briefly reviewed with principal attention focused on the strategy used for selecting optimum stage configurations. The performance map is obtained from the final step of this design optimization exercise. Author

N76-26214 Societe Nationale d'Etudes et de Construction de Moteurs d'Aviation, Moissy-Cramayel (France). Dept. Thermodynamique et Performances Direction Technique.
CHARACTERIZATION OF COMPONENTS PERFORMANCE AND OPTIMIZATION OF MATCHING IN JET-ENGINE DEVELOPMENT
Alain G. Habrard *In* AGARD Mod. Prediction Methods for

Turbomachine Performance Jun. 1976 19 p refs (For availability see N76-26208 17-07)

Design and development of jet-engines require prediction and later, characterization through test analysis, of the performance of the engine and its components. Knowledge of component characteristics is generally synthesized in mathematical models which contribute highly to efficient design and development. At the beginning of development (i.e. before first runs of prototype engines) models are essentially based on estimates and rig test results. Problems are then encountered when engine test results are compared to prediction. Methods using engine test analysis to identify component operating characteristics as installed in the engine and leading to models more representative of aerothermodynamic behavior of engines, are presented. Such models appear to be very useful tools during the various phases of development. Application and coordination with tests are discussed and particularly relative matching of components and control schedules optimization. Author

N76-26215 Defence Scientific Information Service, Ottawa (Ontario).

BIBLIOGRAPHY ON MODERN PREDICTION METHODS FOR TURBOMACHINE PERFORMANCE

A. S. Reeves *In* AGARD Mod. Prediction Methods for Turbomachine Performance Jun. 1976 31 p (For availability see N76-26208 17-07)

A bibliography is presented on numerical techniques for predicting the performance of turbomachines. Topics include boundary layer methods, axial flow compression, turbine blades, damping factors and modern engine design concepts. A.S.K.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N76-26216 Rensselaer Polytechnic Inst., Troy, N.Y.

DISCRETE ON-LINE SYSTEM IDENTIFICATION AND ITS APPLICATION TO DIGITAL FLIGHT CONTROL Ph.D. Thesis

Samir Mohamad Saleh Kotob 1975 226 p

Avail: Univ. Microfilms Order No. 76-13738

A scheme based on the separation between state and parameter estimation was designed. The identification scheme consists of a conditional minimum variance parameter identifier and a linear Kalman filter. The proposed on-line conditional minimum variance parameter identifier embodies both accuracy and computational efficiency. This new formulation results in a linear estimation problem with both additive and multiplicative noise. The resulting filter is shown to utilize both the covariance of the parameter vector itself and the covariance of the error in identification. Using the proposed algorithm, a digital explicit adaptive controller is constructed. The conditional minimum variance filter is used to provide estimates of parameters defining lateral motion of a fighter aircraft, for gain computation. Simulation results indicate that the proposed identification scheme yields useful parameter and state estimates and is more attractive than the extended Kalman filter. Dissert. Abstr.

N76-26217*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

UNCERTAIN DYNAMICAL SYSTEMS: A DIFFERENTIAL GAME APPROACH

Shaul Gutman Apr. 1976 25 p refs

(NASA-TM-X-73135; A-6606) Avail: NTIS HC $3.50 CSCL 12B

A class of dynamical systems in a conflict situation is formulated and discussed, and the formulation is applied to the study of an important class of systems in the presence of uncertainty. The uncertainty is deterministic and the only assumption is that its value belongs to a known compact set. Asymptotic stability is fully discussed with application to variable structure and model reference control systems. Author

N76-26218*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WIND-TUNNEL INVESTIGATION OF A FOWLER FLAP AND SPOILER FOR AN ADVANCED GENERAL AVIATION WING

John W. Paulson, Jr. Washington Jun. 1976 80 p refs

(NASA-TN-D-8236; L-10736) Avail: NTIS HC $5.00 CSCL 01C

The wing was tested without fuselage or empennage and was fitted with approximately three-quarter span Fowler flaps and half span spoilers. The spoilers were hinged at the 70 percent chord point and vented when the flaps were deflected. Static longitudinal and lateral aerodynamic data were obtained over an angle of attack range of -8 deg to 22 deg for various flap deflections and positions, spoiler geometries, and vent lip geometries. Lateral characteristics indicate that the spoilers are generally adequate for lateral control. In general, the spoiler effectiveness increases with increasing angle of attack, increases with increasing flap deflections, and is influenced by vent lip geometry. In addition, the data show that some two-dimensional effects on spoiler effectiveness are reduced in the three-dimensional case. Results also indicate significant increase in lift coefficient as the Fowler flaps are deflected; when the flap was fully deflected, the maximum wing lift coefficient was increased about 96 percent. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N76-26219*# McDonnell Aircraft Co., St. Louis, Mo.

ULTRAVIOLET CORONA DETECTION SENSOR STUDY Final Report, Jul. - Dec. 1975

R. J. Schmitt and Mathern 31 Mar. 1976 83 p refs

(Contract NAS9-14613)

(NASA-CR-147774; MDC-A4054) Avail: NTIS HC $5.00 CSCL 14B

The feasibility of detecting electrical corona discharge phenomena in a space simulation chamber via emission of ultraviolet light was evaluated. A corona simulator, with a hemispherically capped point to plane electrode geometry, was used to generate corona glows over a wide range of pressure, voltage, current, electrode gap length and electrode point radius. Several ultraviolet detectors, including a copper cathode gas discharge tube and a UV enhanced silicon photodiode detector, were evaluated in the course of the spectral intensity measurements. The performance of both silicon target vidicons and silicon intensified target vidicons was evaluated analytically using the data generated by the spectroradiometer scans and the performance data supplied by the manufacturers. Author

N76-26220*# Scientific Translation Service, Santa Barbara, Calif.

REDUCTION OF DRAG BY FLEXIBLE WALLS

R. Mattout Washington NASA Jun. 1976 41 p Transl. into ENGLISH from Assoc. Techn. Maritime et Aeronautique (France), no. 72, 1972 p 207-227

(Contract NASw-2791)

(NASA-TT-F-17089; Bulletin-72) Avail: NTIS HC $4.00 CSCL 14B

Tests were carried out in a hydrodynamic wind tunnel. The experimental model was placed on a wall balance with a fluid bearing. Compared to the drag of a rigid wall, a reduction of 7 percent was observed with passive walls. A reduction of 25 percent was obtained with active walls, and a propulsion effect was noted for several configurations. Author

N76-26221*# Wichita State Univ., Kans. Dept. of Aeronautical Engineering.

DEVELOPMENT OF CAPABILITIES FOR STALL/SPIN RESEARCH Final Report, 1 Jun. 1975 - 20 Jun. 1976

Andrew Craig 20 Jun. 1976 42 p
(Grant NsG-1189)
(NASA-CR-148287) Avail: NTIS HC $4.00 CSCL 14B

Apparatus and techniques were developed for measuring in a low-speed wind tunnel the static and dynamic (rotary balance) aerodynamic data pertinent to spin behavior of a general aviation aircraft. The main results were: (1) collection of static force and moment data for several airplane configurations at angles of attack from 0 to 90 degrees and angles of sideslip from 0 to 40 degrees; and (2) difficulties, shortcomings, and unsuitability of some aspects of the rotary balance mount as constructed were discovered and identified for avoidance in a new design for a mount. Author

N76-26222# Comptroller General of the United States, Washington, D.C.
FEDERAL AVIATION ADMINISTRATION'S AIRPORT CERTIFICATION PROGRAM: HAS IT RESULTED IN SAFE AIRPORTS?
8 Aug. 1975 35 p refs
Avail: NTIS HC $4.00

The Federal Aviation Administration's efforts to upgrade the safety of airports used by the traveling public are discussed. Minimum safety standards for the operation of airports and a certification program were established. Improvements resulting from the airport certification program include upgrading firefighting and rescue equipment, reducing hazards caused by obstructions, and establishing and improving emergency plans. J.M.S.

N76-26223*# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
ANALYTICAL WORK IN SUPPORT OF THE DESIGN AND OPERATION OF TWO DIMENSIONAL SELF STREAMLINING TEST SECTIONS Semiannual Progress Report, Oct. 1975 - Mar. 1976
M. Judd, S. W. D. Wolf, and M. J. Goodyer Mar. 1976 67 p refs
(Grant NsG-7172)
(NASA-CR-148196) Avail: NTIS HC $4.50 CSCL 14B

A method has been developed for accurately computing the imaginary flow fields outside a flexible walled test section, applicable to lifting and non-lifting models. The tolerances in the setting of the flexible walls introduce only small levels of aerodynamic interference at the model. While it is not possible to apply corrections for the interference effects, they may be reduced by improving the setting accuracy of the portions of wall immediately above and below the model. Interference effects of the truncation of the length of the streamlined portion of a test section are brought to an acceptably small level by the use of a suitably long test section with the model placed centrally. Author

N76-26224*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SCHLIEREN SYSTEM EMPLOYING ANTIPARALLEL REFLECTOR IN THE FORWARD DIRECTION Patent Application
William D. Gunter, Jr., inventor (to NASA) Filed 9 Jun. 1976 19 p
(NASA-Case-ARC-10971-1; US-Patent-Appl-SN-694402) Avail: NTIS HC $3.50 CSCL 14E

An invention relating generally to a system for rendering visible a phase object such as a density gradient whose index of refraction differs from that of its surroundings was described. The system described employs a reflector in the forward direction which offsets and reflects rays of light passing through a test region in which the phase object is located so that they are returned in an antiparallel direction spaced from the test region toward a receiving system proximate to a light source. Since the source is positioned proximate to the optical receiver, the system is not subject to the precise alignment and rigidity requirements of the conventional schlieren systems and is only minimally affected by flexure of its support. NASA

N76-26225*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL INVESTIGATION OF END TREATMENTS FOR NONRETURN WIND TUNNELS
William T. Eckert, Kenneth W. Mort, and J. E. Piazza Washington Jun. 1976 56 p refs Sponsored jointly with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-3402; A-6206) Avail: NTIS HC $4.50 CSCL 14B

The results of a series of flow quality and performance tests on several inlet and exit configurations for nonreturn wind tunnels are presented. Test section flow angularities, local dynamic pressure variations, and total-pressure-loss variations are presented as functions of wind-to-test-section dynamic pressure ratio. The results show that a nonreturn wind tunnel should have end treatments with three characteristics: (1) a vertical exit system, (2) a horizontal inlet system, and (3) an area of protected enclosure at the inlet. Inlet and exhaust treatments were developed that produced good aerodynamic flow qualities with low power penalties. Author

N76-26226# Maryland Univ., College Park. Dept. of Physics and Astronomy.
SOME HIGHLIGHTS OF THE UNIVERSITY OF MARYLAND CYCLOTRON
H. G. Pugh Jul. 1975 13 p refs
(ORO-4856-48) Avail: NTIS HC $3.50

A review is given of the beam energies, the cyclotron layout, the personnel, and use of the Maryland Cyclotron. The discussion of some of the experiments includes: (1) pion production; (2) elastic proton scattering at 100 MeV; (3) quasi-free processes; (4) gamma rays following proton bombardment; (5) highly excited nuclear states; and (6) rearrangement energy. ERA

N76-26227# California Univ., Berkeley. Lawrence Berkeley Lab.
VERY HIGH ENERGY HEAVY-ION ACCELERATORS
H. A. Grunder Oct. 1975 6 p refs Presented at the Intern. Conf. on Heavy Ion Sources, Gatlinburg, Tenn., 27 Oct. 1975
(Contract W-7405-eng-48)
(LBL-4602; Conf-751048-7) Avail: NTIS HC $3.50

A review is given of various programs for building heavy ion accelerators. Topics discussed are (1) options of reaching very high energies with heavy ions; (2) present performance of the superHILAC and the Bevalac; (3) heavy ion sources; (4) applications of heavy ion accelarators outside of basic research; and (5) reliability and operating costs of heavy ion sources. NSA

N76-26228# European Space Agency, Paris (France).
DISPLACEMENT CORRECTIONS IN SUBSONIC WIND TUNNELS WITH BULKY MODELS AND WITH GROUND SIMULATION
Gerhard Schulz Dec. 1975 119 p refs Transl. into ENGLISH of 'Die Verdraengungskorrekturen in Unterschallwindkanaelen bei sperrigen Modellen u. mit Bodensimulation', DFVLR, Porz, West Ger. Report DLR-FB-74-46, 24 Jun. 1974 Original German report available from DFVLR, Porz, West Ger. DM 45,10
(ESA-TT-218; DLR-FB-74-46) Avail: NTIS HC $5.50

The influence of ground simulation on the displacement corrections and tolerable model size is presented. The influence a bulky volume distribution of the model, as opposed to a compact one, may have on corrections and homogeneity is shown. In order to illustrate the rather complicated relations, the results are presented by numerous diagrams of the jet cross section with curves of constant amount of correction (iso-tau-diagrams). Author (ESA)

N76-26229# Transportation Research Board, Washington, D.C.
AIRCRAFT LANDSIDE CAPACITY
Kenneth W. Heathington, Aaron Gellman, John W. Barnum, Philip H. Beinhaker, and Leo F. Duggan 1975 301 p refs Conf. held at Tampa, Florida, 28 Apr. - 2 May 1975
(PB-249465/6; TRB/SR-159; ISBN-0-309-02462-5) Avail: NTIS HC $9.75 CSCL 01E

Since either the airside or the landside can be the limiter to an airport's capacity and level of service, appropriate criteria and measures of capacity and level of service are needed to ensure that programs are not negated. As a first step in the exploration of needed research and development participants discussed these issues: identification and measurement of levels of service and capacity of airport landside elements, providing and managing airport landside capacity, constraints and their impact on airport landside capacity, influence on airside and

off-airport factors on landside capacity, and alternative methods for landside capacity at existing sites. GRA

N76-26230# Federal Aviation Administration, Washington, D.C.
SLANT VISUAL RANGE/APPROACH LIGHT CONTACT HEIGHT MEASUREMENT TECHNIQUE WITH DATA CONVERTER AND REMOTE READOUT PANEL
26 Oct. 1973 20 p
(AD-A016221; FAA-ER-450-042B) Avail: NTIS CSCL 13/1

This Engineering Requirement (ER) specifies the work required for the development of a slant visual range/approach light contact height measurement technique utilizing currently available instrumentation (either a development (engineering) model or an in-service model). The technique and equipment supplied as a result of these efforts will permit advising a pilot approaching an airport under conditions of poor visibility at what altitude the pilot may expect contact with the approach lights and what segment of approach lights will be visible to him at a decision of height of 100 feet. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N76-26231*# Kanner (Leo) Associates, Redwood City, Calif.
FUTURE SPACE FLIGHT PROGRAM OF THE USA: PROJECTION TO THE TURN OF THE CENTURY
H. W. Koehler Washington NASA May 1976 20 p refs Transl. into ENGLISH from German Report Submitted for Publication
(Contract NASw-2790)
(NASA-TT-F-17086) Avail: NTIS HC $3.50 CSCL 22A

The outlook for a civilian space program over the next 25 years is considered. An essential element of the U.S. space program of the future is the development of the space shuttle. During the 1990's small space stations for scientific and commercial purposes might be established. More ambitious concepts like a manned lunar base, a manned Mars mission or settlement, huge satellite solar power stations, and the evolutionary development of an orbiting colony will not be undertaken before the turn of the century. Because of the high costs involved, the potential economic and social benefits of any future space programs in the U.S.A. would have to be considered quite clearly. Author

N76-26232*# Joint Publications Research Service, Arlington, Va.
EARTH-SPACE-EARTH
V. Bykovskiy Washington NASA Jun. 1976 11 p Transl. into ENGLISH from Nauky Suspilstvo (USSR), no. 4, Apr. 1976 p 9-11 Sponsored by NASA
(NASA-TT-F-17042) Avail: NTIS HC $3.50 CSCL 22A

Potential uses of space research, such as mapping, earth resources, meteorology, communications, manufacturing in space, and medicine are summarized. Problems yet to be solved before long duration space travel can become a reality are discussed. Author

N76-26233*# Joint Publications Research Service, Arlington, Va.
THE SPACE ORBITS OF THE SCIENCES
V. Shikan Washington NASA Jun. 1976 11 p Transl. into ENGLISH from Nauky Suspilstvo (USSR), no. 4, Apr. 1976 p 6-8 Sponsored by NASA
(NASA-TT-F-17043) Avail: NTIS HC $3.50 CSCL 22A

The Simferopol' seminar of the Znannya association is summarized. The seminar was devoted to current problems of space studies. Author

N76-26234# Library of Congress, Washington, D.C. Science Policy Research Div.
UNITED STATES AND SOVIET PROGRESS IN SPACE: SUMMARY DATA THROUGH 1975 AND A FORWARD LOOK
Charles S. Sheldon, II 2 Feb. 1976 94 p
(Rept-76-32-SP) Avail: NTIS HC $5.00

The comparative progress of the U.S.S.R. and the U.S. in the last 18 years in the exploration of space is summarized with a look at possible future developments. Matters of economic and military concern are discussed as well as domestic and international political issues. J.M.S.

N76-26235# Rockwell International Corp., El Segundo, Calif.
SPACE INDUSTRIAL PRODUCTIVITY NEW OPTIONS FOR THE FUTURE
Krafft A. Ehricke Jul. 1975 87 p Presented to the Comm. on Sci. and Tech., and the Subcomm. on Space Sci. and Appl. Hearings on Future Space Programs, Washington, D. C. 22-30 Jul. 1975
Avail: NTIS HC $5.00

The possibilities offered by space industrialization as a logical focus for a future space program were explored. The specific exoindustrial programs discussed include orbital manufacturing, the use of sunlight reflected from space to earth, the transmission and generation of power, and lunar industrialization. The prime justification for the proposed program is that there has to be a return on past and present investments: extraterrestrial environments have a value-generating characteristic of their own, enabling space technology to advance beyond the level of service activities to direct productive utilization of space. For individual titles, see N76-26236 through N76-26243.

N76-26236 Rockwell International Corp., El Segundo, Calif.
THE FRAME OF REFERENCE
In its Space Ind. Productivity New Options for the Future Jul. 1975 p 1-13 (For availability see N76-26235 17-12)

The following perspectives from which the space effort may be considered were investigated: national goal structure and space program, basic options, the web of space industry, exoindustrialization as a materialistic goal, and the credibility gap. The following conclusions were reached: (1) of the three fundamental options for the future non-military national space program, exoindustrialization (productive utilization of the earth-moon system) should be adopted as the overarching concept, (2) the buildup of exoindustrial productivity enhances the labor-intensive and value-generating characteristics of space operations, places space operations into the mainstream of today's national and world scenario, appears to offer the best congruity with important national goals, and strengthens the foundations for future achievements in space exploration, (3) there is no rational justification for another counterproductive downscaling of the nation's aerospace capability following Space Shuttle development and the Viking Landers, such as occurred in the wake of Apollo. Y.J.A.

N76-26237 Rockwell International Corp., El Segundo, Calif. **c85**
EXOINDUSTRIALIZATION IN PERSPECTIVE
In its Space Ind. Productivity New Options for the Future Jul. 1975 p 14-27 (For availability see N76-26235 17-12)

The following points of view from which exoindustrialization may be considered were discussed: (1) historical perspective (incomplete industrialization), (2) socio-economic perspective (continuing exploitation of special raw materials), and (3) environmental perspective (incomplete socio-economic development and inability to look beyond the global resources picture to the vast primordial resources and processing potential available even in the geolunar system alone). The following areas were amplified: (1) space and the evolution of human productivity, (2) space and environment, (3) some consequence of exoindustrialization, (4) exoindustry and a profile of the relevant future, and (5) exoindustrialization and new space initiatives. Y.J.A.

N76-26238 Rockwell International Corp., El Segundo, Calif.
A TIME FOR DECISIONS
In its Space Ind. Productivity New Options for the Future Jul. 1975 p 28-50 (For availability see N76-26235 17-12)

The recognizable options for the U.S. space program were evaluated. It was shown that: (1) the government and the people of the United States should realize that they hold the key to one of the most valuable resources for now and the indefinite future: new environments and the resources and values they contain if properly manipulated, (2) the era in which the national space program is undertaken predominantly for prestige, feasibility

demonstrations and exploration has drawn to a close. The era of extraterrestrial industrialization for the enhancement of productivity and economic utilization offers the logical central strategy of the next phase, while the thread of scientific space exploration should be continued, and (3) space industrialization offers a number of specific goals recognizable today. These goals offer nuclei around which new experiments and programs can be crystallized with the advent of the space shuttles. Author

N76-26239 Rockwell International Corp., El Segundo, Calif.
SURVEY OF GENERIC PROGRAMS
In its Space Ind. Productivity New Options for the Future Jul. 1975 p 51-72 (For availability see N76-26235 17-12)

The following generic programs, applicable to the development of a given capability in terms of a product or a contribution to increasing the quantity or quality of terrestrial productivity, were defined and surveyed: sensory information, earth-oriented teleoperation, near-earth orbit manufacturing, space light, space power, lunar industrialization, space transportation, domiciliary facilities (Spacelab, Space Station and larger), orbital assembly facilities (stabilizers for structural assembly storage facilities, etc.), and cybernetic systems (data processing and display, remote control systems, teleoperators, robot systems, etc.). The first six of these are productive generic programs, the last four are generic supporting programs. The following subjects were also discussed: program merit criteria for judging the future space program, the space station as an exoindustrial facility, astropolis (large-scale near-earth orbit center for industrialization, research and living), and androcell (cellular androsphere, a system self-sufficient enough to seek its own heliocentric orbits). Y.J.A.

N76-26240 Rockwell International Corp., El Segundo, Calif.
SPACE LIGHT
In its Space Ind. Productivity New Options for the Future Jul. 1975 p 73-106 (For availability see N76-26235 17-12)

A discussion dealing with ways in which the use of sunlight on earth may be increased using space technology was presented. The program may be divided into three key objectives: low light level for night illumination (Lunetta), strong light (up to half the solar brightness) for stimulating food growth by enhancing photosynthetic production, and a Soletta system so large that it provides the same brightness as the sun. These systems use light reflectors in space to illuminate at least a small area in relation to the globe, but a fairly large area by customary standards. The principal contributions would include: food/energy conservation, commerce, food production, power, chemical, fuel, and fresh water production. Y.J.A.

N76-26241 Rockwell International Corp., El Segundo, Calif.
THE ELECTRIC ECONOMY AND SPACE
In its Space Ind. Productivity New Options for the Future Jul. 1975 p 107-132 (For availability see N76-26235 17-12)

The possible future applications of space technology to the distribution as well as generation of electric energy were discussed. The following projects were described: (1) a space power system used for large-scale transmission of energy by a microwave beam, (2) a power relay system used for power transmission between two points on earth over great distances from power station to load center, and (3) a space power program (power generation satellite) used to generate electricity in geosynchronous orbit, convert to microwave energy, transmit to consumer (initially primarily on earth), via a shaped microwave beam and reconvert (rectify) to dc electricity. The following areas were also elaborated: placement of the appropriate satellites in orbit, cost comparison, thermonuclear power generation satellite, and fusion power generation satellite. Y.J.A.

N76-26242 Rockwell International Corp., El Segundo, Calif.
LUNAR PRODUCTIVITY CENTER
In its Space Ind. Productivity New Options for the Future Jul. 1975 p 133-156 (For availability see N76-26235 17-12)

A proposed lunar productivity center, consisting of two components, the surface component or lunar industrial zone (LIZ) and the orbiting component or lunar industrial space installation (LISI), was described. This is based on the philosophy that the moon is not only an object of intrinsic scientific interest or a valuable base for astronomical and other scientific research, but is also an economic resource. The general objective of this center is the utilization of lunar environment for raw materials extraction, material processing/manufacturing and industrial consumption of energy. The following key objectives were stated and amplified: (1) extend industrial raw material base beyond sole dependence on terrestrial resources, (2) continue technological, industrial (material processing capacity) and economic growth without adding burdens to the terrestrial environment, (3) utilize lunar environment characteristics for manufacturing new products needed on earth and in extraterrestrial installations. Y.J.A.

N76-26243 Rockwell International Corp., El Segundo, Calif.
PRELIMINARY ESTIMATION OF FRONT END CAPITAL REQUIREMENTS (NON-RECURRING COSTS)
In its Space Ind. Productivity New Options for the Future Jul. 1975 p 157-166 (For availability see N76-26235 17-12)

A preliminary estimate of the non-recurring costs associated with the various projects related to the space industrial productivity was given in the form of charts with the ordinate as time (in years) and the abscissa in billions of 1975 dollars. For better clarity, the main chart is divided into two parts: facilities above the center line, and transportation systems below. Each project is taken as a separate item, so that cost-reducing synergistic effects do not show. Author

N76-26244*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT GUIDANCE AND CONTROL SYSTEMS
Raymond E. Wilson, Jr. Washington Jun. 1976 20 p refs (NASA-TN-D-8249; JSC-S-418) Avail: NTIS HC $3.50 CSCL 22B

The Apollo guidance and control systems for both the command module and the lunar module are described in a summary report. General functional requirements are discussed, and general functional descriptions of the various subsystems and their interfaces are provided. The differences between the original in-flight maintenance concept and the final lunar-orbital-rendezvous concept are discussed, and the background in philosophy, the system development, and the reasons for the change in concept are chronologically presented. Block diagrams showing the command module guidance and control system under each concept are included. Significant conclusions and recommendations contained in more detailed reports on specific areas of the guidance and control systems are included. Author

N76-26245*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APOLLO EXPERIENCE REPORT ENVIRONMENTAL ACCEPTANCE TESTING
Charles H. M. Laubach Washington Jun. 1976 60 p (NASA-TN-D-8271; JSCS-458) Avail: NTIS HC $4.50 CSCL 22B

Environmental acceptance testing was used extensively to screen selected spacecraft hardware for workmanship defects and manufacturing flaws. The minimum acceptance levels and durations and methods for their establishment are described. Component selection and test monitoring, as well as test implementation requirements, are included. Apollo spacecraft environmental acceptance test results are summarized, and recommendations for future programs are presented. Author

N76-26246# Battelle Inst., Frankfurt am Main (West Germany).
POSSIBILITIES OF MANUFACTURING, AND OF SCIENTIFIC RESEARCH IN THE SPACE ENVIRONMENT, AND EFFECTIVE REALIZATION THEREOF (LITERATURE STUDY) [STUDIE UEBER DIE MOEGLICHKEITEN DER FERTIGUNG BZW. DER DURCHFUEHRUNG VON WISSENSCHAFTLICHEN UNTERSUCHUNGEN UNTER WELTRAUMBEDINGUNGEN UND UEBER DEREN ZWECKMAESSIGE GESTALTUNG (LITERATURSTUDIE)]
Rasmus Beck, Karl-Heinz Gruenthaler, Hans Gaar, Dieter Hums, Ulrich Mueller, Gerhard Schanz, Darius Sethna, and Heinrich Winter Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 208 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-1073; GfW-RV-21-V-10/73)
(BMFT-FB-W-75-24) Avail: NTIS HC $7.75; ZLDI, Munich DM 43.70

Ideas for carrying out space experiments in the fields of

materials science and biology as well as the results of experiments conducted during the Apollo 14 and the Skylab missions are summarized. Available literature published up to February 1974 was studied. Important aspects are emphasized for planning future experiments in the fields of ceramics, metals and alloys, composites, single crystals, and biological processes for which space manufacturing appears to be particularly interesting.
Author (ESA)

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N76-26247*# Transemantics, Inc., Washington, D.C.
ALGORITHMS FOR CALCULATING NAVIGATIONAL INFORMATION
B. V. Kugayenko, V. A. Kuzminykh, G. A. Mersov, R. R. Nazirov, N. G. Khavenson, I. G. Khatskevich, N. A. Eysmont, and P. Ye. Elyasberg NASA Jun. 1976 66 p refs Transl. into ENGLISH of "Algoritmy Rascheta Navigatsionnoy Informatsii", Rept. Pr-251 Inst. of Space Res., Acad. of Sci. USSR, Moscow, 1975 61 p
(Contract NASw-2792)
(NASA-TT-F-17058; Pr-251) Avail: NTIS HC $4.50 CSCL 22A

Algorithms are given for navigational fixation of scientific information obtained from long-distance spacecraft (both on cross-country flights and on planetary satellite orbits) and from artificial earth satellites. These algorithms form the basis for a FORTRAN language system of programs designed for navigational calculations on the BESM-6 electronic computer and the RYAD computer. Author

N76-26248*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
PRELIMINARY ENTRY TRAJECTORY FOR 1ST ORBITAL FLIGHT TEST (OFT). SPACE SHUTTLE ENGINEERING AND OPERATIONS SUPPORT, ENGINEERING SYSTEMS ANALYSIS
Kent R. Frohme 10 Mar. 1975 26 p refs
(Contract NAS9-13970)
(NASA-CR-147766; Rept-1.2-DN-B0105-02) Avail: NTIS HC $4.00 CSCL 22A

A preliminary trajectory from entry interface to terminal area energy management interface for the first orbital flight test is presented based on information in the Strawman master flight test assignments document Reference A. The enclosed point-mass trajectory may be utilized for preliminary purposes, meeting the requirements of this document. The trajectory was derived utilizing the January 1975 analytic drag control guidance, the latest thermal protection subsystem model information from NASA ES and December 1974 Aerodynamics for a mid center-of-gravity location. Author

N76-26249*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.
DYNAMIC CONTROL OF SRB THRUST TAILOFF FOR SEPARATION Space Shuttle Engineering and Operations Support
W. W. Webb 15 Jun. 1976 134 p refs
(Contract NAS9-14960)
(NASA-CR-147794; Rept-1.3-DN-C0503-010) Avail: NTIS HC $6.00 CSCL 22A

The use of the difference in chamber pressure between solid rocket booster engines as a controlling signal to the flight control system during booster thrust tailoff was examined. In addition, the control capability of the Generalized Attitude Control System (GACS) was compared to that of the baseline. Results indicate that the difference in chamber pressure signal provided essentially no improvement. However, the GACS is considerably better than the baseline in controlling during tailoff disturbances. Author

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N76-26250*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEVELOPMENT OF A LARGE SUPPORT SURFACE FOR AN AIR-BEARING TYPE ZERO-GRAVITY SIMULATOR
Kenneth E. Glover Apr. 1976 39 p refs
(NASA-TM-X-72780) Avail: NTIS HC $4.00 CSCL 14B

The methods used in producing a large, flat surface to serve as the supporting surface for an air-bearing type zero-gravity simulator using low clearance, thrust-pad type air bearings are described. Major problems encountered in the use of self-leveled epoxy coatings in this surface are discussed and techniques are recommended which proved effective in overcoming these problems. Performance requirements of the zero-gravity simulator vehicle which were pertinent to the specification of the air-bearing support surface are also discussed. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N76-26251*# Kanner (Leo) Associates, Redwood City, Calif.
APPRAISAL OF THE OTRAG CONCEPT OF AN ECONOMICAL LAUNCH VEHICLE SYSTEM
Washington NASA Jun. 1976 16 p refs Transl. into ENGLISH of West German report, 1975 14 p
(Contract NASw-2790)
(NASA-TT-F-17091) Avail: NTIS HC $3.50 CSCL 22D

In assessing the propulsion system of the OTRAG launch-vehicle concept, which is characterized by standardization and simplex construction, the nominal concept, modified modular concepts, and available component developments are examined. In the engine assessment, the individual engine components, performance, and operating behavior are investigated; for the fuel supply system, the blowdown process and the fuel manifold are studied. The prospective masses involved, including the propellant residual and the various reserves, are discussed.
Author

N76-26252*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NASA/ESA CV-990 SPACELAB SIMULATION Final Report
John O. Reller, Jr. Jan. 1976 172 p refs Prepared Jointly with the European Space Agency
(NASA-TM-X-73105; ESA-SL-75-2; A-6442) Avail: NTIS HC $6.75 CSCL 22A

Simplified techniques were applied to conduct an extensive spacelab simulation using the airborne laboratory. The scientific payload was selected to perform studies in upper atmospheric physics and infrared astronomy. The mission was successful and provided extensive data relevant to spacelab objectives on overall management of a complex international payload; experiment preparation, testing, and integration; training for proxy operation in space; data handling; multiexperimenter use of common experimanter facilities (telescopes); multiexperiment operation by experiment operators; selection criteria for spacelab experiment operators; and schedule requirements to prepare for such a spacelab mission. Author

N76-26253*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TETHERED SUBSATELLITE STUDY

William P. Baker, J. A. Dunkin, Zachary J. Galaboff, Kenneth D. Johnston, Ralph R. Kissel, Mario H. Rheinfurth, and Mathias P. L. Siebel Mar. 1976 143 p refs
(NASA-TM-X-73314) Avail: NTIS HC $6.00 CSCL 22A

The results are presented of studies performed relating to the feasibility of deploying a subsatellite from the shuttle by means of a tether. The dynamics, the control laws, the aerodynamics, the heating, and some communication considerations of the tethered subsatellite system are considered. Nothing was found that prohibits the use of a subsatellite joined to the shuttle by a long (100 km) tether. More detailed studies directed at specific applications are recommended. Author

N76-26254*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TITAN/CENTAUR D-1TTC-5 HELIOS B FLIGHT DATA REPORT
K. A. Adams May 1976 177 p
(NASA-TM-X-73435; E-8784) Avail: NTIS HC $7.50 CSCL 22D

The fourth operational flight of the newest NASA unmanned launch vehicle is reported. The spacecraft was the Helios B, the second of two solar probes designed and built by the Federal Republic of Germany. The primary mission objective, to place the Helios spacecraft on a heliocentric orbit in the ecliptic plane with a perihelion distance of 0.29 AU, was successfully accomplished. After successful injection of the Helios spacecraft, a series of experiments were performed with the Centaur stage to demonstrate its operational capabilities. All objectives of the extended mission phase were successfully met. This report presents the analysis of the launch vehicle flight data for the primary mission phase of the TC-5 flight. Author

N76-26255*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A RAPID METHOD FOR OPTIMIZATION OF THE ROCKET PROPULSION SYSTEM FOR SINGLE-STAGE-TO-ORBIT VEHICLES
Charles H. Eldred and Sabina V. Gordon Washington Jul. 1976 33 p refs
(NASA-TN-D-8078; L-10226) Avail: NTIS HC $4.00 CSCL 21H

A rapid analytical method for the optimization of rocket propulsion systems is presented for a vertical take-off, horizontal landing, single-stage-to-orbit launch vehicle. This method utilizes trade-offs between propulsion characteristics affecting flight performance and engine system mass. The performance results from a point-mass trajectory optimization program are combined with a linearized sizing program to establish vehicle sizing trends caused by propulsion system variations. The linearized sizing technique was developed for the class of vehicle systems studied herein. The specific examples treated are the optimization of nozzle expansion ratio and lift-off thrust-to-weight ratio to achieve either minimum gross mass or minimum dry mass. Assumed propulsion system characteristics are high chamber pressure, liquid oxygen and liquid hydrogen propellants, conventional bell nozzles, and the same fixed nozzle expansion ratio for all engines on a vehicle. Author

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N76-26256*# Joint Publications Research Service, Arlington, Va.
FIVE HUNDRED THOUSAND BITS FROM VENUS
R. Svoren Washington NASA Jun. 1976 15 p Transl. into ENGLISH from Nauka Zhizn (USSR), no. 4, Apr. 1976 p 38-43 Sponsored by NASA
(NASA-TT-F-17044) Avail: NTIS HC $3.50 CSCL 17B

Communications aspects of the Venera-9 and Venera-10 missions are reviewed. Some historical developments leading up to these missions are presented, and so are some of the constraints imposed on communications during various mission phases. Author

N76-26257*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEMS SUPPORT FOR THE HELIOS PROJECT. VOLUME 1: PROJECT DEVELOPMENT THROUGH END OF MISSION, PHASE 2
P. S. Goodwin, M. R. Traxler, W. G. Meeks, and F. M. Flanagan 1 Jul. 1976 190 p refs
(Contract NAS7-100)
(NASA-CR-148197; JPL-TM-33-752-Vol-1) Avail: NTIS HC $7.50 CSCL 17I

The overall evolution of the Helios Project is summarized from its conception through to the completion of the Helios-1 mission phase 2. Beginning with the project objectives and concluding with the Helios-1 spacecraft entering its first superior conjunction (end of mission phase 2), descriptions of the project, the mission and its phases, international management and interfaces, and Deep Space Network-spacecraft engineering development in telemetry, tracking, and command systems to ensure compatibility between the U.S. Deep Space Network and the German-built spacecraft are included. Author

N76-26258*# Battelle Columbus Labs., Ohio.
POTENTIAL MARKETS FOR A SATELLITE-BASED MOBILE COMMUNICATIONS SYSTEM Final Report
W. M. Jamieson, C. S. Peet, and R. J. Bengston 16 Apr. 1976 63 p refs
(Contract NASw-2800)
(NASA-CR-148194; BCL-OA-TFR-76-4) Avail: NTIS HC $4.50 CSCL 17B

The objective of the study was to define the market needs for improved land mobile communications systems. Within the context of this objective, the following goals were set: (1) characterize the present mobile communications industry; (2) determine the market for an improved system for mobile communications; and (3) define the system requirements as seen from the potential customer's viewpoint. The scope of the study was defined by the following parameters: (1) markets were confined to U.S. and Canada; (2) range of operation generally exceeded 20 miles, but this was not restrictive; (3) the classes of potential users considered included all private sector users, and non-military public sector users; (4) the time span examined was 1975 to 1985; and (5) highly localized users were generally excluded - e.g., taxicabs, and local paging. Author

N76-26259*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AIRBORNE BALLISTIC CAMERA TRACKING SYSTEMS
William L. Redish Washington Jul. 1976 45 p refs
(NASA-TN-D-8225; L-10639) Avail: NTIS HC $4.00 CSCL 22A

An operational airborne ballistic camera tracking system was tested for operational and data reduction feasibility. The acquisition and data processing requirements of the system are discussed. Suggestions for future improvements are also noted. A description of the data reduction mathematics is outlined. Results from

a successful reentry test mission are tabulated. The test mission indicated that airborne ballistic camera tracking systems are feasible. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N76-26260*# Wyle Labs., Inc., Huntsville, Ala. Scientific Services and Systems Group.

DEVELOPMENT OF MODIFIED VIBRATION TEST CRITERIA FOR QUALIFYING SPACE VEHICLE COMPONENTS

Research Report, 20 May 1975 - 20 May 1976

K. Y. Chang and G. C. Kao May 1976 134 p refs

(Contract NAS8-31414)

(NASA-CR-144340; WR-76-4) Avail: NTIS HC $6.00 CSCL 22B

The results of the evaluation of two response prediction methods relating to the prediction of structural responses of stiffened shell structures with or without attached components, and subjected to broadband acoustic excitations are presented. The methods under evaluation were the constant mass attenuation method and the impedance ratio method. Example problems were used to illustrate the application procedures of these two methods and to compare their predicted results with the experimentally measured data. It is found that more realistic estimates of the structural response can be obtained by the impedance ratio method. Author

N76-26261*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ENVIRONMENTAL CHARGING OF SPACECRAFT-TESTS OF THERMAL CONTROL MATERIALS FOR USE ON THE GLOBAL POSITIONING SYSTEM FLIGHT SPACE VEHICLE. PART 2: SPECIMEN 6 TO 9

N. John Stevens, Frank D. Berkopec, and Richard A. Blech Jun. 1976 44 p

(NASA-TM-X-73436; E-8789) Avail: NTIS HC $4.00 CSCL 22B

The NASA/USAF program on the Environmental Charging of Spacecraft Surfaces consists, in part, of experimental efforts directed toward evaluating the response of materials to the environmental charged particle flux. Samples of thermal blankets of the type to be used on the Global Positioning System Flight Space Vehicles were tested to determine their response to electron flux. The primary result observed was that no discharges were obtained with the quartz-fiber-fabric-covered multilayer insulation specimen. The taped aluminized polyester grounding system used on all specimens did not appear to grossly deteriorate with time; however, the specimens require specific external pressure to maintain constant grounding system resistance. Author

N76-26262# Lockheed Missiles and Space Co., Palo Alto, Calif.

INVESTIGATION OF THE FUNDAMENTAL CHARACTERISTICS OF ELECTROSTATIC COSMIC RADIATION SHIELDS ON THE KOSMOS-605. 2. MEASUREMENT RESULTS

E. E. Kovalev, E. D. Molchanov, Iu. G. Pekhterev, T. Ia. Riabova, and B. I. Tikhomirov [1976] 8 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 14, no. 1, 1976 p 126-132

Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Results of direct measurements of the conduction currents in an electrostatic shield model on the Kosmos-605 are presented. For the first time the possibility of producing and maintaining electrical fields 1 mil to 10 mil v/m near an artificial earth satellite under prolonged space flight conditions by using the vacuum surrounding the space vehicle as insulating medium is shown experimentally. The fundamental characteristics of an electrostatic shield are determined from the measurement results and the deduction is made that an effective electrostatic shield from the charged particles of earth's radiation belts, requiring minimal weight and low energy supply, can be produced on the basis of modern high-voltage facilities. Author

N76-26263*# McDonnell-Douglas Technical Services Co., Inc., Houston, Tex.

APU/HYDRAULIC/ACTUATOR SUBSYSTEM COMPUTER SIMULATION. SPACE SHUTTLE ENGINEERING AND OPERATION SUPPORT, ENGINEERING SYSTEMS ANALYSIS

24 Mar. 1975 48 p refs

(Contract NAS9-13970)

(NASA-CR-147768; Rept-1.2-DN-B0105-03) Avail: NTIS HC $4.00 CSCL 22B

Major developments are examined which have taken place to date in the analysis of the power and energy demands on the APU/Hydraulic/Actuator Subsystem for space shuttle during the entry-to-touchdown (not including rollout) flight regime. These developments are given in the form of two subroutines which were written for use with the Space Shuttle Functional Simulator. The first subroutine calculates the power and energy demand on each of the three hydraulic systems due to control surface (inboard/outboard elevons, rudder, speedbrake, and body flap) activity. The second subroutine incorporates the R. I. priority rate limiting logic which limits control surface deflection rates as a function of the number of failed hydraulic. Typical results of this analysis are included, and listings of the subroutines are presented in appendicies. Author

N76-26264*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MULTI-STAR PROCESSING AND GYRO FILTERING FOR THE VIDEO INERTIAL POINTING SYSTEM

James Patrick Murphy Jun. 1976 124 p refs

(NASA-TM-X-73130; A-6595) Avail: NTIS HC $5.50 CSCL 22B

The video inertial pointing (VIP) system is being developed to satisfy the acquisition and pointing requirements of astronomical telescopes. The VIP system uses a single video sensor to provide star position information that can be used to generate three-axis pointing error signals (multi-star processing) and for input to a cathode ray tube (CRT) display of the star field. The pointing error signals are used to update the telescope's gyro stabilization system (gyro filtering). The CRT display facilitates target acquisition and positioning of the telescope by a remote operator. Linearized small angle equations are used for the multistar processing and a consideration of error performance and singularities lead to star pair location restrictions and equation selection criteria. A discrete steady-state Kalman filter which uses the integration of the gyros is developed and analyzed. The filter includes unit time delays representing asynchronous operations of the VIP microprocessor and video sensor. A digital simulation of a typical gyro stabilized gimbal is developed and used to validate the approach to the gyro filtering. Author

N76-26265# Hawker Siddeley Dynamics Ltd., Hatfield (England).

EVALUATION OF ESRO 4 IN-FLIGHT THERMAL DATA

K. Hecks Paris ESA Feb. 1976 107 p refs

(Contract ESTEC-1763/72)

(ESA-CR-574) Avail: NTIS HC $5.50

Temperature measurements made in flight on the ESRO 4 satellite were compared with the transient computer predictions based on the existing thermal mathematical model. Six orbit cases were considered, representing early and late orbits for each of three attitudes with respect to the sun. For the predictions, the appropriate correct orbit and attitude data were used together with internal powers derived from appropriate switching voltage and current telemetry data. Results show good correlation for the temperatures of internal units, floors, etc. in all cases; correlation is less good for the external structures and thermal covers. Author (ESA)

N76-26266# Naval Postgraduate School, Monterey, Calif.

EFFECTS OF CERTAIN CONFIGURATION PARAMETERS ON A PARTICULAR AIR TO AIR INTERCEPTOR MISSILE WITH OPTIMAL GUIDANCE

I. Bert Russak Oct. 1975 34 p refs

(AD-A019941; NPS-54Ru75103) Avail: NTIS CSCL 16/4

During the summer of 1973 at the request of the Naval Missile Center, Pt Mugu, CA, the author initiated a study to determine how much potential performance limits could be improved for a conceptual air to air interceptor missile through the use of a variable thrust engine together with optimal guidance techniques. Significant improvements in performance were achieved in the sense of reducing time to intercept. The present work extends those results by showing the sensitivity of this improvement to configuration changes such as the inclusion of aerodynamic surfaces and thrust-impulse level changes to the missile.

Author (GRA)

N76-26267# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

DESIGN AND ANALYSIS OF AIR-TO-AIR MISSILE USING DIGITAL CONTROL THESIS M.S. Thesis

Thomas R. Callen Dec. 1975 110 p refs

(AD-A019853; GE/EE/75-17) Avail: NTIS CSCL 16/4

The design of automatic control systems is one of the most critical and important tasks that the air-to-air missile control engineer must accomplish. The advantages of low cost, high reliability and low power requirements, along with the small space requirements, make digital controllers a very attractive device for this purpose. This thesis presents the engineering techniques that can be employed to develop a mathematical model of a generic missile and also to design a digital controller for the system. The basic missile's stability and performance are evaluated in both the continuous and discrete domains, for angles of attack of 0 and 30 degrees. The effects of sampling time are demonstrated, and direct digital design techniques are presented, with the resulting digital controllers being evaluated as to their effect on system performance. Pitch rate control is investigated in addition to pitch attitude control. GRA

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N76-26268# Accumetrics Corp., Cambridge, Mass.

PIEZOELECTRIC TRIAXIAL ACCELEROMETER SYSTEM FOR USE IN SATELLITE AIR DENSITY MEASUREMENTS Final Report, Apr. 1972 - Jun. 1975

Donald H. Fryklund L. G. Hanscom Field, Mass. AFCRL Sep. 1975 60 p

(Contract F19628-72-C-0225; AF Proj. 6690)

(AD-A020039; AC-211; AFCRL-TR-75-0574) Avail: NTIS CSCL 14/2

A piezoelectric triaxial accelerometer system has been evolved for use in satellite based neutral air density measurements. Piezoelectric bimorphs are heavily loaded with masses that are clamped at sea level and are released in orbit by the use of pyrodevices. The satellite spin provides signal chopping to enable narrow-banding to reduce noise. GRA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion*, *28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N76-26269 Stanford Univ., Calif.

MINIMUM THRUSTORS CONTROL OF A SPINNING DRAG-FREE SATELLITE, INCLUDING DESIGN OF A LARGE CAVITY SENSOR Ph.D. Thesis

Ronald Lee DeHoff 1976 293 p

Avail: Univ. Microfilms Order No. 76-12991

Translational control can be accomplished with a minimum of two thrustors which produce opposing force components along the spin axis, and a component in the spin plane. The minimum thrustors control law is described which determines the proper algorithm for producing stable system motion. The stability limits are theoretically derived for operation with time delays. The effect of external forces on the stability and performance is discussed. An optical sensor is proposed, using fluorescent re-emission from the proof mass excited by a pulsed ultraviolet source. Orthogonally mounted, single axis sensors provide a three dimensional position measurement of the proof mass position via a current imbalance proportional to the centroid of the light flux incident on the sensor strip. Frequency separation of the excited and excitant light flux allows three-axis operation using a single exciting source. A discrete measurement time history is provided which is applicable to direct digital computer processing. Dissert. Abstr.

N76-26270*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL AND THEORETICAL INVESTIGATION OF FATIGUE LIFE IN REUSABLE ROCKET THRUST CHAMBERS

Ned P. Hannum, Harold J. Kasper, and Albert J. Pavli 1976 33 p refs Presented at the 12th Propulsion Conf., Palo Alto, Calif., 26-28 Jul. 1976; sponsored by the Am. Inst. of Aeronautics and Astronautics and the Soc. of Automotive Engineers

(NASA-TM-X-73413; E-8745) Avail: NTIS HC $4.00 CSCL 21H

During a test program to investigate low-cycle thermal fatigue, 13 rocket combustion chambers were fabricated and cyclically test fired to failure. Six oxygen-free, high-conductivity (OFHC) copper and seven Amzirc chambers were tested. The failures in the OFHC copper chambers were not typical fatigue failures but are described as creep rupture enhanced by ratcheting. The coolant channels bulged toward the chamber centerline, resulting in progressive thinning of the wall during each cycle. The failures in the Amzirc alloy chambers were caused by low-cycle thermal fatigue. The zirconium in this alloy was not evenly distributed in the chamber materials. The life that was achieved was nominally the same as would have been predicted from OFHC copper isothermal test data. Author

N76-26271*# Alabama A & M Univ., Huntsville. School of Technology.

ROCKET ENGINE THRUST CHAMBER WALL TEMPERATURE DISTRIBUTION CALCULATION AND ANALYSIS Final Report

Hrishikesh Saha May 1976 41 p refs

(Grant NsG-8022)

(NASA-CR-148288) Avail: NTIS HC $4.00 CSCL 21H

An analytical computational concept is presented which predicts the temperature profiles along a regeneratively cooled thrust chamber wall on the hot gas side and on the coolant side, and also the coolant bulk temperature profile. The computational model is based upon a coupling of the boundary layer heat transfer process with the heat transfer process through the chamber wall and the coolant flow heat absorption. The calculation is started with approximate temperature distributions for the hot gas side wall and the coolant flow. The iteration process of the computer program is terminated when the total heat transfer rates from the hot gas boundary layer to the wall and from the wall to the coolant are equal. The computer program for the integration of regenerative cooling process to a thrust chamber is kept general such that this program can be used with any boundary layer analysis computer program for temperature profile and heat transfer studies. A sample application of this concept is shown by using a boundary layer analysis program for the RL10 rocket engine thrust chamber. Author

N76-26272# Atomics International, Canoga Park, Calif.

SYSTEMS FOR NUCLEAR AUXILIARY POWER Annual Report, Government Fiscal Year 1975

30 Sep. 1975 167 p refs

(Contract AT(04-3)-701)

(AI-ERDA-13163) Avail: NTIS HC $7.60

The system and component engineering and test activities relating to the ZrH reactor are described. The specific objectives

which were pursued during FY 1975 were to: investigate standardized ZrH reactor-TE, -Brayton, and -organic Rankine space power systems and components; perform conceptual analysis and design of ZrH reactor-organic Rankine power systems for subsea applications; perform tests on key space system components; conduct fuel hydriding and hydrogen barrier investigations; and perform system studies in support of the Department of Defense (DOD) and their contractors as directed by the Energy Research and Development Administration (ERDA). Author (NSA)

N76-26273# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.

ANALYTIC MASS MODEL OF CHEMICAL ROCKET STAGES FOR SPACE FLIGHT MISSIONS. PART 1: MODEL DESCRIPTION

Maurice M. Bunn, Juergen Broschk, and Detlef Manski 26 Feb. 1976 55 p refs In GERMAN; ENGLISH summary Report will also be announced as translation

(DLR-FB-76-16-Pt-1) Avail: NTIS HC $4.50; DFVLR, Cologne DM 21.70

A method is presented to design transfer stages for different systems of chemical propellants and constructions. The influence of construction and performance parameters on system mass for different space missions was investigated systematically. Methods for computing and optimizing system masses of 15 selected stage designs are described, and a FORTRAN program is presented. Further comparison of such mass-optimized transfer stages is possible, based on additional criteria. Author (ESA)

N76-26274# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

DEVELOPMENT OF A 400 Hz SINE WAVE INVERTER Final Report

W. Denzinger Feb. 1976 75 p refs

(Contract ESTEC-2293/74-AK)

(ESA-CR(P)-800) Avail: NTIS HC $4.50

A trade-off of different sine wave generation principles was made and the one best suited for the specified requirements of the 400 Hz inverter was selected. A PWM bridge inverter with limited output power was breadboarded to get detailed information about this inverter type. A step wave inverter was considered the best solution and breadboarded for the specified output power. The function and the performance of this breadboard are explained in detail. Author (ESA)

N76-26275# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Ground Equipment/ Materials Directorate.

THE EXAMINATION OF FIVE M-54 MOTOR CASES THAT FAILED ACCEPTANCE TESTS

Ronald G. Britton 13 Nov. 1975 27 p

(AD-A020070; RL-76-8) Avail: NTIS CSCL 21/8

Five M-54 rocket motor cases that had failed force cone acceptance tests were analyzed for cause of failure. Tensile properties and surface finish were measured and chemical and metallographical analyses were performed. All failures were related to agglomeration of Al-Cr-Fe compound particles. GRA

N76-26276# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

VEHICLE POTENTIAL CONTROL BY MEANS OF ELECTRON EMISSION Instrumentation Papers

Christopher Sherman 18 Aug. 1975 33 p refs

(AD-A019634; AFCRL-TR-75-0445; AFCRL-IP-238) Avail: NTIS CSCL 22/2

A system for controlling the potential of a vehicle (rocket or satellite) in flight by use of an emitted current of low energy electrons is described. Diagnostic instruments for measuring the efficacy of such a system are discussed. Results of the use of such a system on a sounding rocket launched into the lower ionosphere are presented. GRA

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N76-26277*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

METHOD OF INHIBITING MAILLARD REACTION BROWNING IN FOOD PRODUCTS Patent Application

Kenneth A. Buckle (Minn. Univ., St. Paul), Theodore P. Labuza (Minn. Univ., St. Paul), and Henry C. Warmbier, inventors (to NASA) (Minn. Univ., St. Paul) Filed 21 May 1976 22 p Sponsored by NASA

(NASA-Case-MSC-14835-1; US-Patent-Appl-SN-688853) Avail: NTIS HC $3.50 CSCL 06H

A method is described of inhibiting chemical or nonenzymatic browning in food caused by the reaction of an amino group and a reducing compound by admixing with the food an edible humectant. NASA

N76-26278*# National Aeronautics and Space Administration. Pasadena Office, Calif.

ALDEHYDE-CONTAINING UREA-ABSORBING POLYSACCHARIDES Patent Application

William A. Mueller (JPL), George C. Hsu (JPL), and Harold E. Marsh, Jr., inventors (to NASA) (JPL) Filed 15 Mar. 1976 10 p

(Contract NAS7-100)

(NASA-Case-NPO-13620-1; US-Patent-Appl-SN-666992) Avail: NTIS HC $3.50 CSCL 07C

A novel aldehyde-containing polymer (ACP) is prepared by reaction of a polysaccharide with periodate to introduce aldehyde groups onto the C2 - C3 carbon atoms and by introduction of ether and ester groups onto the pendant primary hydroxyl to modify solubility characteristics. The ACP is utilized to absorb nitrogen bases such as urea in vitro or in vivo. NASA

N76-26279*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

MASS SPECTROMETRY OF AEROSPACE MATERIALS

J. A. Colony Washington Jun. 1976 20 p refs

(NASA-TN-D-8261; G-7692) Avail: NTIS HC $3.50 CSCL 07D

Mass spectrometry is used for chemical analysis of aerospace materials and contaminants. Years of analytical aerospace experience have resulted in the development of specialized techniques of sampling and analysis which are required in order to optimize results. This work has resulted in the evolution of a hybrid method of indexing mass spectra which include both the largest peaks and the structurally significant peaks in a concise format. With this system, a library of mass spectra of aerospace materials was assembled, including the materials responsible for 80 to 90 percent of the contamination problems at Goddard Space Flight Center during the past several years. Author

24 COMPOSITE MATERIALS

Includes laminates.

N76-26280 Iowa Univ., Iowa City.

THE STATICAL METHOD OF DESIGNING AXISYMMETRIC SANDWICH PLATES SUBJECT TO ALTERNATIVE LOADS Ph.D. Thesis

Shiny Ting 1975 171 p

Avail: Univ. Microfilms Order No. 76-13453

The minimal weight design of sandwich plates whose rigid plastic face sheets obey the Tresca yield condition, and which is subject to two alternative loads, is systematically determined by the method of stress variation. Both annular and full plates are treated. When both of the loads are unidirectional, the general solutions are obtained for all cases of classical support conditions for which the shear forces are statically determinate. The optimal design solutions are depicted in the form of design

charts. Five comprehensive examples are presented to illustrate the method. Dissert. Abstr.

N76-26281*# National Aeronautics and Space Administration. Pasadena Office, Calif.
GRAPHITE REINFORCED BONE CEMENT Patent Application
Albert C. Knoell, inventor (to NASA) (JPL) Filed [1976] 14 p (Contract NAS7-100)
(NASA-Case-NPO-13764-1; US-Patent-Appl-SN-674194) Avail: NTIS HC $3.50 CSCL 11A

A surgical bone cement that has mechanical properties more nearly matched to those of animal bone and thermal curing characteristics which result in less traumatization of body tissues is reported. A dispersion of short high modulus graphite fibers within a bonder composition includes polymer dissolved in a reactive monomer such as polymethylmethacrylate dissolved in a methylmethacrylate monomer. NASA

N76-26282*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
BEARING MATERIAL Patent Application
Harold E. Sliney, inventor (to NASA) Filed 25 Sep. 1975 28 p
(NASA-Case-LEW-11930-2; US-Patent-Appl-SN-616528) Avail: NTIS HC $4.00 CSCL 11D

A composite material is described which will provide low friction surfaces for materials in rolling or sliding contact and is self-lubricating and oxidation resistant up to and in excess of about 930 C. The composite is comprised of a metal component which lends strength and elasticity to the structure, a fluoride salt component which provides lubrication, and a glass component which not only provides oxidation protection to the metal but may also enhance the lubrication qualities of the composite. NASA

N76-26283*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ESTER IMPURITIES IN PMR-POLYIMIDE RESIN
Richard W. Lauver 1976 14 p refs Presented at A Critical Rev. of Techniques for the Characterization of Polymeric Mater., Watertown, Mass., 6-8 Jul. 1976
(NASA-TM-X-73444; E-8798) Avail: NTIS HC $3.50 CSCL 11D

Spectral and chomatographic studies were conducted which established the presence of tri- and tetraester impurities in aged monomer solutions employed in fabrication of PMR-polyimide resin composites. The equilibrium constant and apparent rate of the esterification were determined. It was demonstrated, using differential scanning calorimetry, that the ortho-ester moiety of these impurities does not completely react at typical cure conditions. It is concluded that voids formed in composites fabricated with aged monomer solution are due to gaseous decomposition products evolved by ester impurities and/or unreacted amine during elevated temperature post-cure treatment. Author

N76-26284*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXTREME TEMPERATURE THERMAL CONTROL COATING Patent Application
Lyle E. Johnson, inventor (to NASA) (Martin Marietta Corp., Denver) Filed 21 May 1976 6 p Sponsored by NASA
(NASA-Case-LAR-11756-1; US-Patent-Appl-SN-688879) Avail: NTIS HC $3.50 CSCL 11C

A thermal control coating is disclosed which may be applied to a flexible substrate. The coating remains pliant and resistant to abrasion over a wide temperature range. NASA

N76-26285*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF PREPARING ZINC ORTHOTITANATE PIGMENT Patent Application
Daniel W. Gates, Yoshiro Harada (IIT Res. Inst.), William R. Logan (IIT Res. Inst.), and John E. Gilligan, inventors (to NASA) (IIT Res. Inst.) Filed 17 Jun. 1976 12 p
(Contract NAS8-26791)
(NASA-Case-MFS-23345-1; US-Patent-Appl-SN-696989) Avail: NTIS HC $3.50 CSCL 11C

A method of preparing zinc orthotitanate in a form suitable for use as a pigment in spacecraft thermal control coatings is presented. For optimum reflectance of solar energy a very fine particle size, primarily below one micron, and absence of absorption edge characteristic of uncombined zinc oxide are required. Zinc orthotitanate is prepared by heating a slightly zinc deficient mixture of precipitated zinc oxalate and titanium oxalate. The oxalate mixture, which can be prepared by combining separately precipitated zinc oxalate and titanium oxalate or by co-precipitation of mixed oxalates from chloride solution, is heated to 400 to 600 C to remove volatile decomposition products and is then rapidly heated at 900 to 1,200 C, and preferably at about 1,000 to 1,050 C. Zinc is provided in the reaction mixture in an amount slightly less than the stoichiometric 2:1 zinc-to-titanium molar ratio for formation of orthotitanate so as to avoid the presence in the product pigment of small amounts of zinc oxide. NASA

N76-26286*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
HONEYCOMB-LAMINATE COMPOSITE STRUCTURE Patent Application
William J. Gilwee and John A. Parker, inventors (to NASA) Filed 22 Jun. 1976 35 p
(NASA-Case-ARC-10913-1; US-Patent-Appl-SN-698646) Avail: NTIS HC $4.00 CSCL 11D

A honeycomb-laminate composite structure comprising: (1) a cellular core of a polyquinoxaline foam in a honeycomb structure, and (2) a layer of a non-combustible fibrous material impregnated with a polyimide resin laminated on the cellular core, is described. A process for producing the honeycomb-laminate composite structure is shown. NASA

N76-26287*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TENSILE BEHAVIOR OF UNNOTCHED AND NOTCHED TUNGSTEN-COPPER LAMINAR COMPOSITES
Charles A. Hoffman Washington Jun. 1976 34 p refs
(NASA-TN-D-8254; E-8069) Avail: NTIS HC $4.00 CSCL 11D

Relations were studied between the tensile strengths of unnotched and of notched, and elastic moduli of unnotched laminar sheet or foil composites and the amounts of reinforcement. Tungsten was used as the reinforcement and copper as the matrix, and the tests were run at room temperature. Three thicknesses of tungsten (i.e., 0.00254, 0.0127, and 0.0254 cm (0.001, 0.005, and 0.010 in) were used and the nominal volume fraction of tungsten was varied from about 0.05 to 0.95. It was found that the tensile strength of the unnotched specimens could be related to the amount of reinforcement, as could the elastic moduli, and that these values could be predicted by use of the rule of mixtures. The tensile strengths of the notched laminar composites could be predicted by use of the rule of mixtures using strengths for notched constituents, provided notch effects did not predominate. Author

N76-26288# Science Research Council, Chilton (England).
POST IRRADIATION MECHANICAL PROPERTIES OF RADIATION RESISTANT CAST EPOXY RESIN SYSTEMS
J. T. Morgan and G. B. Stapleton Jul. 1975 40 p refs
(RL-75-136) Avail: ERDA Depository Libraries HC $4.00

The changes in mechanical properties, with irradiation, of various cast epoxy resin formulations are tabulated for integrated doses of up to ten to the 10th power rad. The formulations chosen are representative of the more radiation resistant types. Furthermore consideration has been given to systems that are capable of curing at ambient temperatures. Traditional systems have been included in this experiment for comparison. Author (NSA)

N76-26289# Max-Planck-Institut fuer Metallforschung, Stuttgart (West Germany). Pulvermetallurgisches Lab.
SHEET-LIKE COMPOSITE MATERIALS CONSISTING OF BERYLLIUM AND DUCTILE METALS [SCHICHTVERBUNDWERKSTOFFE AUS BERYLLIUM UND DUKTILEN METALLEN]

Fritz Aldinger and Rainer Dietrich Bonn Bundesmin. fuer Forsch. u. Technol. Dec. 1975 69 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-WRT-2074; GfW-RV-11-B-20/74)
(BMFT-FB-W-75-25) Avail: NTIS HC $4.50; ZLDI, Munich DM 14,50

Sheet-like composites with interlayers of silver between beryllium and TiAl6V4 or stainless steel (No. 4541) were produced by diffusion bonding and subsequent rolling or direct rolling at 740 C. Four-point bend tests showed the following results: (1) Above a critical value of the product of the yield stress and the thickness of the plating material, an abrupt increase in the elongation of beryllium occurs. Microcracks in beryllium near the ductile plating are stopped due to the reinforcement of the plating. Therefore, in regions adjacent to the micro-cracks stress levels higher than in unplated material are induced before macroscopic failure occurs. Above a certain value of these stresses more and more prism slip occurs along with the normal basal slip increasing elongation. (2) In multi-sandwich sheets only the outermost ductile material increases the elongation in beryllium. Inside layers of ductile material do not deform appreciably and are therefore not active in increasing the crack propagation energy for microcracks near the outside surface where the stresses are highest. Author (ESA)

N76-26290# Dornier-System G.m.b.H., Friedrichshafen (West Germany).
DEVELOPMENT OF FIBER REINFORCED COMPOSITE MATERIALS WITH METALLIC MATRIX Final Report [ENTWICKLUNG FASERVERSTAERKTER VERBUNDWERKSTOFFE MIT METALLISCHER MATRIX]
Winfried Koehler and Karl Frieder Sahm Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 116 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-29) Avail: NTIS HC $5.50; ZLDI, Munich DM 24,40

Production processes, test methods, and properties of fiber reinforced aluminum alloys are described. Methods such as plasma spraying, hot pressing and continuous infiltration are applied to produce boron fiber reinforced metals. The embedding of discontinuous fibers, for instance SiC-whiskers, was carried out by powder metallurgical or liquid infiltration methods. In order to clear up some principal questions adhesion and wetting investigations were made for the sessile drop method.
Author (ESA)

N76-26291# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Abteilung Kunststoffe.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS ON FIBER REINFORCED PLASTIC LANDING GEAR SPRING BLADES FOR LIGHT AIRCRAFT
Rainer Schuetze 12 Jan. 1976 37 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-76-06) Avail: NTIS HC $4.00; DFVLR, Cologne DM 16,20

The development of several landing gear spring blades for lightweight aircraft is discussed. A special sandwich structure provided high longitudinal stresses in the faces and high shear stresses in the sandwich core. The length of the spring blades made a high bending stiffness necessary; therefore apart from glass fibers, reinforcements with higher Young-modulus as carbon- and Kevlar-49-fibers were also provided for tensile sandwich faces. All blades were statically and dynamically tested on a gravitational fall test-bed. Using Kevlar-49-fibers in the tensile sandwich face, the structural weight could be further reduced and damping conditions improved compared with the GRP-sandwich blade. Author (ESA)

N76-26292# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
AN INVESTIGATION OF REACTION SINTERED SILICON NITRIDE AS A RADOME MATERIAL Final Report, 1 Mar. - 31 Aug. 1975
Joe N. Harris Oct. 1975 63 p refs
(Contract N00019-75-0372)
(AD-A019133; GIT-A-1724-F) Avail: NTIS CSCL 17/9

Eleven reaction sintered silicon nitride radomes were prepared by slip casting silicon blanks and reaction sintering in nitrogen to determine the repeatability of electrical transmission characteristics, examine methods of sealing porous radomes, investigate possible flight attachment systems, and prepare a radome with attachment for rain erosion sled testing. Only two of fifteen castings were lost in the mold. Dry density varied from 1.58 to 1.89 gm/cu cm due to variation in viscosity and particle size distribution of the slip. Final densities of radomes completing the reaction sintering cycle varied from 2.55 to 2.76 gm/cu cm. Electrical transmission patterns were made on six of the radomes using swept frequency techniques. At the frequency representing a half-wave wall thickness for the particular density of each radome, transmission losses were of the order of a few dB. Weight gained during nitriding was not a good indicator of electrical transmission capability. Acceptable transmission patterns were made on radomes with apparent weight gains as low as 50 percent. Radomes sealed against moisture by impregnating or surface coating with silicone resin were not degraded in electrical performance by the sealing. A dense reaction sintered silicon nitride attachment ring was self-bonded into a lower density reaction sintered silicon nitride radome as a demonstration of the feasibility of this approach for attachment systems. Low expansion carbon composite rings tailored to match the expansion of silicon nitride were also considered for attachment rings. GRA

N76-26293# Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF SELF-LUBRICATING COMPOSITES UTILIZING CARBONIZED PHENOLIC MATRIX Interim Technical Report, 1 Dec. 1974 - 31 Jul. 1975
Melvin T. Lavik and Vern Hopkins Dec. 1975 62 p refs
(Contract F33615-75-C-5101; AF Proj. 7343)
(AD-A020954; AFML-TR-75-175-Pt-1) Avail: NTIS CSCL 11/8

Exploratory development and evaluation has been conducted on self-lubricating composites which utilize a carbonized phenolic resin (CPR) matrix. Composites have been prepared with as much as 38% (vol.) graphite fibers. Specimens have been compression-molded directly as journal liners within a metal housing or as blanks which can be machined into desired test configurations. Additives such as Sb_2O_3, ZnO, and tetrafluoroethylene powders have provided beneficial synergistic effects within the CPR-MoS_2-fiber composites. Screening friction and wear tests have been conducted. The composites with more than 30% fiber performed better at the high loads than those with lower fiber content. Small quantities of tetrafluoroethylene powder (2%) effected a lower, more steady friction coefficient while maintaining a low wear rate. Oscillatory journal bearing tests have been conducted at loads from 2,000 to 10,000 psi at an average linear speed of 2.18 fpm (0.011 m/s) and at temperatures of 100, 400, and 600 F (311, 477, and 588 K). The composites containing 31% fibers exhibited much better wear resistance than composites with 18% fiber content. The wear factors of the better composites tended to decrease with increasing load and increasing temperature. Although the specific wear factors are higher by factors of 10 to 400 in oscillating journal tests than in flat-on-flat oscillatory tests, the radial wear is within the stated acceptable wear for control surface bearings in high load applications. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N76-26294*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTROCHEMICAL DEPOSITION OF SILVER CRYSTALS ABOARD SKYLAB 4
P. G. Grodzka (Lockheed Missiles and Space Co., Huntsville, Ala.), B. R. Facemire, M. H. Johnston, and D. W. Gates

Washington Jul. 1976 44 p refs
(Contract NAS8-27015)
(NASA-TN-D-8277; M-173) Avail: NTIS HC $4.00 CSCL 20L

Silver crystals were grown aboard Skylab 4 by an electrochemical reaction and subsequently returned to earth for comparison with crystals grown at 1- and 5-g. Both the Skylab and earth-grown crystals show a variety of structures. Certain tendencies in structure dependency on gravity level, however, can be discerned. In addition, downward growing dendrite streamers; upward growing chunky crystal streamers; growth along an air/liquid interface; and ribbon, film, and fiber crystal habits were observed in experiments conducted on the ground with solutions of varying concentrations. It was also observed that the crystal structures of space and ground electro-deposited silver crystals were very similar to the structures of germanium selenide and germanium telluride crystals grown in space and on the ground by a vapor transport technique. Consideration of the data leads to the conclusions that: (1) the rate of electrochemical displacement of silver ions from a 5 percent aqueous solution by copper is predominantly diffusion controlled in space and kinetically controlled in 1- and higher-g because of augmentation of mass transport by convection; (2) downward and upward crystal streamers are the result of gravity-driven convection, the flow patterns of which can be delineated. Lateral growths along an air/liquid interface are the result of surface-tension-driven convection, the pattern of which also can be delineated; (3) electrolysis in space or low-g environments can produce either dendritic crystals with more perfect microcrystalline structures or massive, single crystals with fewer defects than those grown on ground or at higher g-levels. Ribbons or films of space-grown silicon crystals would find a ready market for electronic substrate and photocell applications. Space-grown dendritic, metal crystals present the possibility of unique catalysts. Large perfect crystals of various materials are desired for a number of electronic and optical applications; and (4) vapor transport growth of germanium selenide and germanium telluride is affected by convection mechanisms similar to the mechanisms hypothesized for the electrochemical deposition of silver crystals. Evidence and considerations leading to the preceding summaries and conclusions are presented. The implications of the findings and conclusions for technological applications are discussed, and recommendations for further experiments are presented. Author

N76-26295# Sandia Labs., Albuquerque, N.Mex.
RELATION OF IRON, ALUMINUM, AND SILICON LAYER THICKNESSES TO THE ELECTRON MICROPROBE BEAM SIZE
W. B. Estill and J. E. Smugeresky Dec. 1975 23 p refs
(Contract AT(29-1)-789)
(SAND-75-8296) Avail: NTIS HC $3.50

Nonconventional standards containing layers of known thicknesses of iron, aluminum, and silicon in a beryllium matrix were used to determine the effect of the size of a region enriched in these elements on the X-ray emission generated by an electron microprobe beam. These thicknesses were nominally 0.5, 1.0, 2.0, 5.0, and 10.0 mu m and represent regions with dimensions of the order of the effective spot size. By analyzing these layers, calibration curves were generated to allow corrections to be made to standard intensities used for quantitative analyses in this size regime. As a result, a procedure was developed to allow a more accurate quantitative analysis of regions as small as 0.5 mu m using characteristic X-ray emission. NSA

N76-26296# Addis Translations International, Woodside, Calif.
ELECTROLYTIC FABRICATION OF CALIBRATION SOURCES IN ALPHA SPECTROMETRY
K. Irlweck and H. Sopantin Nov. 1975 23 p refs Transl. into ENGLISH from the Austrian report SGAE-2368 Sponsored by ERDA Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-10983; SGAE-2368) Avail: NTIS HC $3.50

The most important electrolysis methods described in the literature for the preparation of calibration samples are compiled. Studies on the completeness of the electrolytic deposition of Pu-239 showed that quantitative deposition was obtained after 30 min. The preparation of U, Np, and Am samples by electrolytic deposition was also reported. Results of calibration measurements using U solutions are shown graphically. It was concluded that the electrolysis method is suitable for the preparation of samples for alpha spectrometry studies. NSA

N76-26297# Addis Translations International, Woodside, Calif.
THEORETICAL CALCULATION OF THE SOLUBILITY OF HYDROGEN IN SOLID AND LIQUID METALS
E. S. Filippov 1973 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Chern. Met. (USSR), no. 7, 1973 p 122-128 Sponsored by ERDA
(UCRL-Trans-10735) Avail: NTIS HC $4.00

The solubility of H in solid and liquid metals was investigated in a wide range of temperatures. The model of spheres of interaction was applied to the solubility of hydrogen by a method developed for the solubility of oxygen in equilibrium with a deoxidizing agent. In the polycrystalline representation of a liquid metal the sum of the solubilities in clusters (main vplume) and in the disordered zone are considered. It is therefore easy to take delta V/sub m.p./ as the part of the volume relating to the disordered zone (termed statistical packing (s.p.)), and V/sub s/ as the clusters. The results show that dissolution in s.p. microregions (if such exist) is difficult. Dissolution in vacancies and pores is not dissolutions in microregions of the disordered zone, and the additional solubility increment associated with delta V/sub m.p./ does not relate to a direct increase of the disordered zone or s.p. microregions. The property of grain boundaries to condense appreciable quantities of material cannot be extended to disordered microregions of the liquid.
Author (NSA)

N76-26298# European Space Agency, Paris (France).
MEASUREMENT OF VIBRATIONAL RELAXATION OF HF IN A SHOCK TUBE
Gerhard Rimpel Feb. 1976 47 p refs Transl. into ENGLISH of 'Messung der Schwingungrelaxation von HF im Stossrohr', DFVLR, Stuttgart Report DLR-FB-74-60, 8 Aug. 1974 Original German report available from DFVLR, Porz, West Ger. DM 17,80
(ESA-TT-247; DLR-FB-74-60) Avail: NTIS HC $4.00

Mixtures of HF and Ar, as well as for HF, H2 and Ar, were heated in a shock tube. The resulting vibrational relaxation of HF was monitored via infrared radiation at 2.67 micron. Vibrational relaxation times for the V-T-processes HF(1) + AR (reversible) HF (0) + Ar and HF (1) + HF (reversible) HF (0) + HF were deduced. The vibrational relaxation time of V-T-process HF(1) +H2 reversible HF(0) + H2 cannot be determined quantitatively. Probably its value is of the same order of magnitude as specified by J.F. Bott and N. Cohen.
Author (ESA)

N76-26299# European Space Agency, Paris (France).
HYDROGEN PRODUCTION BY WATER ELECTROLYSIS
Andreas Gann Feb. 1976 58 p refs Transl. into ENGLISH of 'Ueber die Herstellung von Wasserstoff durch Wasserelektrolyse', DFVLR, Stuttgart Report DLR-Mitt-74-39, 30 Oct. 1974 Original German report available from DFVLR, Porz, West Ger. DM 24,60
(ESA-TT-250; DLR-Mitt-74-39) Avail: NTIS HC $4.50

A survey is presented of the operation, design and economic viability of large-scale plants for the production of hydrogen by electrolysis. The present state of the development of modified processes is examined. Author (ESA)

N76-26300# Rockwell International Corp., McGregor, Tex.
ROLE OF FERRIC OXIDE SURFACE AREA IN PROPELLANT BURN RATE ENHANCEMENT (FIRST STEP TOWARD MODELING) Final Report, 1 Jul. 1974 - 30 Jun. 1975
C. H. Burnside 30 Jun. 1975 62 p refs
(Contract F44620-75-C-0002)
(AD-A013855/2; R-4889; AFOSR-75-1188TR) Avail: NTIS HC $4.50 CSCL 21I

Results of efforts to correlate composite propellant burn rate, ammonium perchlorate particle size distribution, and ferric oxide specific surface and level are presented. Results from laboratory-scale motor firings with HTPB- and CTPB-based propellants containing ferric oxides of 3 to 26.4 m squared/gm were used. The oxides had been prepared by precipitation and by calcination of either ferric sulfate or yellow iron oxide. Outcome of the

analysis is a quantitative summarization of a mass of data showing how the several oxides perform in terms of their specific surface and level and as a function of oxidizer particle size distribution. Results indicate Fe2O3 specific surface is more significant at high fine-AP levels than at low fine-AP levels. GRA

N76-26301# Fluorochem, Inc., Azusa, Calif.
HIGH ENERGY HALOGEN CHEMISTRY Annual Report, Dec. 1974 - 1 Dec. 1975
Kurt Baum, Jerald S. Horn, and Duane A. Lerdal Jan. 1976 48 p refs
(Contract N00014-71-C-0176; NR Proj. 093-052)
(AD-A019807) Avail: NTIS CSCL 07/3

The objective of this research program is to synthesize new functional groupings with potential utility in high energy propellants and explosives. Fluorodinitroalkyl groups on silicon were constructed by nitrite displacement of halogen, oxidative nitration and fluorination. 3,3-Dinitrobutyl and fluorodinitroethoxymethyl derivatives of silicon were also synthesized. Phenyl was used as a silicon blocking group in the synthesis of (3-fluoro-3,3-dinitropropyl)methyl polysiloxane. Reactions of olefins with dichlorine heptoxide are described. GRA

N76-26302# Aerospace Corp., El Segundo, Calif.
LINE-BY-LINE CALCULATIONS OF HOT-GAS SPECTRA INCLUDING HF AND HCl Interim Report
Charles M. Randall 4 Dec. 1975 106 p refs
(Contract F04701-75-C-0076; DARPA Order 2843)
(AD-A019573; TR-0076(6970)-6; SAMSO-TR-75-288) Avail: NTIS CSCL 20/6

Low- and medium-resolution spectra are presented of hot nonuniform gas samples in the 2- to 5 microns spectral region based on line-by-line radiance computations. Two gas samples are considered. The first contains CO2, CO, and H2O as the active radiating species. The second contains HF and HCl as the active species. The radiation transmitted to the top of the atmosphere from these samples is also computed. The Air Force Cambridge Research Laboratories spectral line atlas was used to obtain line parameters for gases that are atmospheric constituents. The computation from basic molecular constants of the required additional HCl and HF line parameters for the v = 0-1, 1-2, 2-3, 3-4, and 0-2 bands, including lines of importance in hot samples, is described in detail, and the resulting line parameters are listed. These computed line parameters agree well with available observations by several investigators at both low and high temperatures. As expected, the AFCPL atlas is found, by comparison with experimental spectra, to be quite adequate for modeling samples at terrestrial temperatures, but somewhat lacking in the lines required for complete modeling of samples at high temperature. Author

N76-26303# Office of Naval Research, London (England).
INTERNATIONAL SYMPOSIUM ON FLAMES AS REACTIONS IN FLOW
Duncan E. Dodds Dec. 1976 9 p Symp. held at Padua, Italy, 15-17 Dec. 1975
(AD-A021854; ONRL-C-2-76) Avail: NTIS CSCL 21/2

The Second International Symposium on Flames as Reactions in Flow was attended primarily by combustion chemists and physicists from 11 countries. The symposium covered research on conventional and high intensity (propellant and plasma) flames. The 37 papers presented dealt with the mechanisms and kinetics of combustion, pollutant foundation and control, chemical syntheses in flames, thermal decomposition of hydrocarbons, combustion radiative diagnostics and reactivity of vibrationally excited molecules. Though primarily basic in nature, the results reported included concepts of immediate practicality.
Author (GRA)

N76-26304# Vermont Univ., Burlington. Dept. of Chemistry.
SPECTROSCOPIC AND MAGNETIC STUDIES OF A MIXED VALENCE IRON FLUORIDE, Fe2 F5.7 H2O
E. G. Walton, P. J. Corvan, D. B. Brown, and P. Day 20 Feb. 1976 13 p refs Presented at the Natl. Meeting of the Am. Chem. Soc., 170th, Chicago, Aug. 1975
(Contract N00014-75-C-0756)
(AD-A021756; TR-1) Avail: NTIS CSCL 07/4

The mixed-valence iron fluoride, Fe2F5.7H2O, has been investigated by a variety of techniques including Mossbauer and electronic spectroscopy and magnetic susceptibilities. The material is found to be a Class I mixed-valence complex, and is shown to contain discrete Fe(H2O)6(++) and FeF5(H2O)(--) ions.
Author (GRA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N76-26305 Northwestern Univ., Evanston, Ill.
FATIGUE CRACK PROPAGATION AND ADHESIVELY BONDED CRACKS Ph.D. Thesis
Chiun-Tsu Lin 1975 90 p
Avail: Univ. Microfilms Order No. 76-12163

When cyclic loadings are applied to a material containing a one-dimensional slit (notch) or a penny-shaped crack, a crack is initiated at the tip after a certain number of cycles, and the crack starts to grow. Crack initiation cycle and crack propagation rate are theoretically predicted from a given cyclic stress-strain relation and an effective surface energy. The cyclic stress-strain relation is approximated by a linear work-hardening, subjected to a cyclic hardening or a cyclic softening. Numerical results of a one-dimensional slit are compared with the experimental data on 4140 steel. Also, one of two overlapping sheets which are bonded by an adhesive is assumed to be cracked, and the other is undamaged. The stress intensity factor at the crack tip is diminished due to the effect of the adhesive. Two specific geometries are considered: a crack in an infinite medium and an array of cracks in an infinite medium. Dissert. Abstr.

N76-26306 Illinois Inst. of Tech., Chicago.
HEAT CONDUCTION IN SUPERCONDUCTING LEAD THALLIUM ALLOYS Ph.D. Thesis
Jen-Lig Nick Ho 1975 124 p
Avail: Univ. Microfilms Order No. 76-13148

The heat conduction of six strong-coupling superconducting Pb-Tl alloy specimens were investigated with the emphasis on the effects of impurities upon the phonon thermal conductivity. All the specimens were annealed at 275 C for one week. The study showed that the superconducting state phonon thermal conductivity of Pb-Tl is in reasonably good agreement with BRT theory. The results presented also show that the phonon thermal conductivity at low temperatures of well annealed lead-thallium alloys can be analyzed in terms of phonon scattering by the grain boundaries, point defects, conduction electrons and other phonons. The phonon-dislocation scattering was found to be unimportant. The phonon relaxation rate due to point defects is in reasonably good agreement with the Klemens theory for the long range strain field scattering introduced by the thallium impurities. At low temperatures, the normal state phonon thermal conductivity showed an increase in the phonon-electron relaxation rate as the thallium concentration increases. Dissert. Abstr.

N76-26307 Florida Univ., Gainesville.
INCREMENTAL PLASTIC STRESS WAVES IN ALUMINUM AND COPPER RODS UNDER AXIAL QUASISTATIC PRELOADING Ph.D. Thesis
Chang-Sheng Ting 1975 170 p
Avail: Univ. Microfilms Order No. 76-12140

Test results indicated that except near the plateau in the records for aluminum any given level of incremental particle velocity propagates along the rod with a constant speed, not affected by the strain rate within the small range of the incremental wave strain rates encountered. However, the obtained propagation speed function for each incremental wave was found dependent on both prestrain and prestrain-rate values. A precondition parameter composed of prestrain and prestrain rate was proposed to give a quantitative description of this phenomenon. Numerical computer solutions were obtained for incremental waves at various prestrain levels of both aluminum and copper specimens. Results show that the proposed quasilinear constitutive equation is adequate for copper, and the semilinear constitutive equation is qualitatively adequate for aluminum. Both strain-rate-independent

and strain-rate-dependent theories were used to interpret the experimental results. Dissert. Abstr.

N76-26308 California Inst. of Tech., Pasadena.
THE ELECTRICAL AND MAGNETIC PROPERTIES OF AMORPHOUS Pd-Cu-P ALLOYS Ph.D. Thesis
Gregory Ligot Tangonan 1976 97 p
Avail: Univ. Microfilms Order No. 76-14251

The amorphous phases of the Pd-Cu-P system were obtained using the technique of rapidly quenching from the liquid state. Broad maxima in the diffraction pattern were obtained in the X-ray diffraction studies which are indicative of a glasslike structure. The electrical resistivity for the Pd-Cu-P alloys decreases with temperature as T(2) at low temperatures and as T at high temperatures up to the crystallization temperature. The observed negative temperature coefficients of resistivity in the amorphous alloys are interpreted as due to the modification of the density of states with temperature through the electron-phonon interaction. The weak Pauli paramagnetism of the Pd-Cu-P, Pt-Ni-P and Pd-Ni-P alloys is interpreted as modification of the transition d-states as a result of the formation of strong transition metal-metalloid bonds rather than a large transfer of electrons from the glass former atoms (P in this case) to the D-band of the transition metal in a rigid band picture. Dissert. Abstr.

N76-26309 Stanford Univ., Calif.
A STUDY OF HIGH TEMPERATURE CREEP OF DISPERSION STRENGTHENED Ni AND Ni-20Cr Ph.D. Thesis
Richard Winchell Lund 1976 100 p
Avail: Univ. Microfilms Order No. 76-13036

The high temperature creep properties of dispersion strengthened polycrystalline Ni-2ThO2 and single crystals of Ni-20Cr-2ThO2 were investigated. Single crystals of Ni-20Cr-2ThO2 were cut from plates having a large elongated grain structure and constant stress vacuum creep tests were conducted at various stresses and temperatures. The creep activation energy was found to be nearly equal to that for self diffusion of Ni-20Cr indicating that high temperature creep of dispersion strengthened metals is a thermally activated process controlled by self diffusion. The stress dependence of the creep rate of the single crystals was large and variable, with power law exponents ranging from 9 to 75. The ductility ranged from 40 to 60 percent. The percentage elongation varied inversely with the stress exponent and ranged from 1 to 28 percent. The creep strength can be described by a simple sum of the creep strength of unthoriated polycrystalline Ni-20Cr and the Orowan strength, as calculated from the measured ThO2 particle distribution. Dissert. Abstr.

N76-26310 Stanford Univ., Calif.
AN INVESTIGATION OF THE EFFECTS OF PRECIPITATE FREE ZONES ON THE MECHANICAL BEHAVIOR OF AN ALUMINUM-ZINC-MAGNESIUM ALLOY Ph.D. Thesis
Patrick Peter Paul Pizzo 1976 289 p
Avail: Univ. Microfilms Order No. 76-13065

An investigation to clarify the role of precipitate free zones (PFZ's) on the tensile ductility of a precipitation hardenable alloy at 293K, and to investigate the influence of grain boundary PFZ's on the creep ductility at 473K is discussed. Characterization of the microstructure revealed that a range of PFZ widths could be achieved while maintaining constancy of coupled microstructural parameters. Relative thermal stability of the resultant microstructure permitted acquisition of creep data over a broad range of strain rate. Correlation of the mechanical properties data with deformation morphology observations indicate that PFZ's at grain boundaries affect the fracture behavior at both 293K and 473K in a similar fashion. The importance of mechanical constraints in limiting the extent of deformation in the grain boundary PFZ's is introduced in this study. Dissert. Abstr.

N76-26311 California Univ., Los Angeles.
PRECIPITATION HARDENING IN Cu3Au-Co ALLOYS Ph.D. Thesis
Ibrahim Aly Ibrahim 1976 150 p
Avail: Univ. Microfilms Order No. 76-12201

The intent of this study was to compare the effectiveness of the precipitation hardening of ordered versus disordered Cu3Au by Co precipitates. Pairs of single crystal compression specimens of Cu3Au containing 1.5 and 0.64 at. % Co were aged at 450 C for times up to 200 hr, after which one sample of each pair was heat-treated for the purpose of ordering the Cu3Au matrix. The precipitation hardening behavior of the disordered and ordered samples was investigated by measuring the CRSS at 77, 183, 300 and 373 K. Both the disordered and ordered 1.5% Co samples showed a classic precipitation hardening response with peak strength at about 10 and 20 hr, respectively. The 0.64% Co alloy did not average up to 40 hr. The average particle size as a function of aging time was determined using a superparamagnetic method and transmission electron microscopy. Dissert. Abstr.

N76-26312*# TRW Equipment Labs., Cleveland, Ohio.
ULTRAHIGH VACUUM, HIGH TEMPERATURE, LOW CYCLE FATIGUE OF COATED AND UNCOATED RENE 80 Final Report, 17 Jun. 1974 - 17 Feb. 1976
C. S. Kortovich Apr. 1976 64 p refs
(Contract NAS3-17830)
(NASA-CR-135003; TRW-ER-7861) Avail: NTIS HC $4.50 CSCL 11F

A study was conducted on the ultrahigh vacuum strain controlled by low cycle fatigue behavior of uncoated and CODEP B-1 aluminide coated Rene' 80 nickel-base superalloy at 1000 C (1832 F) and 871 C (1600 F). The results indicated little effect of coating or temperature on the fatigue properties. There was, however, a significant effect on fatigue life when creep was introduced into the strain cycles. The effect of this creep component was analyzed in terms of the method of strainrange partitioning. Author

N76-26313# Materials Research Labs., Maribyrnong (Australia).
THE MEASUREMENT OF THICKNESS OF NON-MAGNETIC COATINGS ON ROUGH STEEL SUBSTRATES WITH THE PERMASCOPE TYPE ES8e3G2
L. H. Esmore Nov. 1975 9 p refs
(TN-379) Avail: NTIS HC $3.50

The single contact permascope probe with the model ES8e3G2 instrument has been compared with the earlier two contact probe and model ES3e4J4a instrument for the measurement of zinc coatings on a series of rough steel substrates. Serious errors due to orientation of the two contact probe on some rough surfaces have been largely overcome with the new probe. Author

N76-26314# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
ACTIVITY OF FERROUS OXIDE IN SLAGS
Y. Wanibe, Y. Yamauchi, K. Kawai, and H. Sakao 1976 21 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (Dusseldorf), v. 44, no. 9, 1973 p 711-717
(NRC/CNR-TT-1867) Avail: NTIS HC $3.50

The electrochemical determination of ferrous oxide activity was described for the following systems: FeO-SiO2, FeO-MnO-SiO2, and FeO-CaO-SiO2; the temperature range investigated is 1,250 to 1,350 C, and the technique used involves measuring the activity of oxygen in a silver bath in equilibrium with its molten slag using a ZrO2 (CaO) solid electrolyte. The standard free energy of the reaction Fe(gamma) + 0.5 O2(g) = FeO(1) was determined. The oxidation power of slags and the possibilities of calculating the basicity of slags were discussed. Author

N76-26315*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ULTRASONIC MEASUREMENT OF STRESS IN 2219-T87 ALUMINUM PLATE
W. N. Clotfelter and E. R. Risch Jun. 1976 26 p refs
(NASA-TM-X-73315) Avail: NTIS HC $4.00 CSCL 11F

The basic relationship of ultrasonic signal velocity to directional subsurface stress is reviewed. Inappropriateness of dependency on a single correlative value of constant for a three dimensional stress field in metallic materials is discussed. Implementation of conventional ultrasonic nondestructive testing capabilities integrated to provide a composite technique for the measurement of orthogonal stress components is described, and the procedures for performing the preparatory calibration and subsequent stress field measurements are presented. In conclusion, the prime effect of stress on ultrasonic signal velocity occurs

only in the direction of material excitation or particle motion.
Author

N76-26316*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RESISTANCE OF NICKEL-CHROMIUM-ALUMINUM ALLOYS TO CYCLIC OXIDATION AT 1100 C AND 1200 C
Charles A. Barrett and Carl E. Lowell Washington Jun. 1976 40 p refs
(NASA-TN-D-8255; E-8615) Avail: NTIS HC $4.00 CSCL 11F

Nickel-rich alloys in the Ni-Cr-Al system were evaluated for cyclic oxidation resistance in still air at 1,100 and 1,200 C. A first approximation oxidation attack parameter Ka was derived from specific weight change data involving both a scaling growth constant and a spalling constant. An estimating equation was derived with Ka as a function of the Cr and Al content by multiple linear regression and translated into countour ternary diagrams showing regions of minimum attack. An additional factor inferred from the regression analysis was that alloys melted in zirconia crucibles had significantly greater oxidation resistance than comparable alloys melted otherwise. Author

N76-26317*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF CASTING GEOMETRY ON MECHANICAL PROPERTIES OF TWO NICKEL-BASE SUPERALLOYS
James R. Johnston, Robert L. Dreshfield, and Henry E. Collins (TRW, Inc., Cleveland) Washington Jun. 1976 17 p refs
(NASA-TM-X-3386; E-8661) Avail: NTIS HC $3.50 CSCL 11F

An investigation was performed to determine mechanical properties of two rhenium-free modifications of alloy TRW, and to evaluate the suitability of the alloy for use in a small integrally cast turbine rotor. The two alloys were initially developed using stress rupture properties of specimens machined from solid gas turbine blades. Properties in this investigation were determined from cast to size bars and bars cut from 3.8 by 7.6 by 17.8 cm blocks. Specimens machined from blocks had inferior tensile strength and always had markedly poorer rupture lives than cast to size bars. At 1,000 C the cast to size bars had shorter rupture lives than those machined from blades. Alloy R generally had better properties than alloy S in the conditions evaluated. The results show the importance of casting geometry on mechanical properties of nickel base superalloys and suggest that the geometry of a component can be simulated when developing alloys for that component. Author

N76-26318# Rochester Univ., N.Y. Dept. of Mechanical and Aerospace Sciences.
DIFFUSIONAL CREEP OR MULTICOMPONENT SYSTEMS Progress Report, 1 Feb. 1975 - 31 Jan. 1976
J. C. M. Li 1976 45 p refs
(Contract E(11-1)-2296)
(COO-2296-10) Avail: NTIS HC $4.00

Hydrogen embrittlement was studied from the viewpoint of the interaction of hydrogen with the stress field of particles. The interaction between dislocation loops was studied to include shear components of the Burgers vector. It turned out that this additional component could stabilize both the cuboidal arrangement and the stair-step configuration of square dislocation loops. These results were used to explain certain precipitation morphologies. Equipment improvements are reported. The only creep results obtained so far were the temperature and stress dependence of penetration velocity on a beta-tin single crystal, and the stress dependences of lead and succinonitrile polycrystals. They agree with literature data. NSA

N76-26319# Case Western Reserve Univ., Cleveland, Ohio.
ELASTIC AND PLASTIC STRAINS AND THE STRESS CORROSION CRACKING OF AUSTENITIC STAINLESS STEELS Progress Report, 30 Apr. 1975 - 30 Dec. 1975
A. R. Troiano Dec. 1975 20 p
(Contract E(11-1)-2576)
(COO-2576-2) Avail: NTIS HC $3.50

Homogeneous deformation of type 310 austenitic stainless steel only slightly influenced the corrosion potential in a boiling 3 percent NaCl aqueous environment. The difference in a deaerated solution was of the order of .25 mV and somewhat more for an aerated solution. Elastic strains appeared to have little or no influence on the corrosion potential for fully annealed as well as 10 percent and 25 percent homogeneously deformed 310 steel. Oxygen in the environment shifted the corrosion potential several hundred millivolts in the less active direction. The critical cracking potential in a deaerated 3 percent NaCl solution was approximately the same for the annealed and homogeneously deformed specimens at approximately -125 mV.
NSA

N76-26320# Babcock and Wilcox Co., Alliance, Ohio. Research Center.
VARIABILITY IN CREEP AND RUPTURE TEST RESULTS IN A SINGLE HEAT OF TYPE 304 STAINLESS STEEL: R AND D REPORT LR:75:4213-01:3
W. E. Leyda and C. C. Schultz Sep. 1975 158 p refs Sponsored by ERDA
(ORNL-SUB-3654-3) Avail: NTIS HC $6.75

Test results were obtained as part of a program to develop and verify high temperature structural design methods for liquid metal fast breeder reactor system components. A single heat of material (heat 9T2796) is being used throughout the program, by all investigators and in several product forms, to minimize the problem of heat-to-heat variations in elevated temperature behavior. The same laboratory reanneal was specified for each product form to reduce differences in behavior among the several being used. The data discussed was obtained from the 5/8-inch diameter, hot-rolled bar product form. The laboratory reanneal was performed after machining to minimize specimen-to-specimen differences. In spite of these efforts to reduce data variability, significant scatter was observed in both short-time and long-time deformation response, and also in time-to-rupture results.
Author (NSA)

N76-26321# California Univ., Berkeley. Lawrence Berkeley Lab.
ELECTRON MICROSCOPY STUDIES OF ION IMPLANTED SILICON Ph.D. Thesis
K. Seshan Nov. 1975 108 p refs
(Contract W-7405-eng-48)
(LBL-2728) Avail: NTIS HC $5.50

The nature of defects resulting from the implantation of phosphorous ions into doped silicon and a model of how they form are reported. This involved an electron microscope study of the crystallographic defects that form upon annealing. Images formed by these crystallographic defects are complex, and nonconventional imaging techniques are required for their characterization. The images of these small defects (about 300A) are sensitive to various parameters, such as foil thickness, their position in the foil, and diffracting conditions. The defects were found to be mostly interstitial hexagonal Frank loops lying on the four [111] planes and a few perfect interstitial loops. In addition, rod like linear defects that are shown to be interstitial are also found. It was found that the linear defects require boron for their formation. Dissert. Abstr.

N76-26322# Dartmouth Coll., Hanover, N.H. Dept. of Physics and Astronomy.
EXPERIMENTAL DETERMINATION OF THE TEMPERATURE DEPENDENCE OF METALLIC WORK FUNCTIONS AT LOW TEMPERATURES Progress Report, 1 Mar. 1975 - 9 Feb. 1976
P. B. Pipes 1976 10 p
(Contract E(11-1)-2314)
(COO-2314-9) Avail: NTIS HC $3.50

Progress described includes measurements of the temperature dependence of the work functions for niobium and aluminum between 2 and 20 K and the development of a simple theoretical model to explain the effects of adsorbed He-4 gas on the temperature dependence of work function in niobium.
Author (NSA)

N76-26323# Atomic Energy of Canada Ltd., Pinawa (Manitoba).
YOUNG'S MODULUS OF CRYSTAL BAR ZIRCONIUM AND ZIRCONIUM ALLOYS (ZIRCALOY-2, ZIRCALOY-4, ZIRCONIUM-2.5wt PERCENT NOIBIUM TO 1000K
H. E. Rosinger, I. G. Ritchie, and A. J. Shillinglaw Sep. 1975

25 p refs
(AECL-5231) Avail: ERDA Depository Libraries HC $3.50

Data on both the dynamic Young's moduli and shear moduli of the alloys were measured at room temperature and Young's modulus as function of temperature was determined over the temperature range 300 to 1000 K. In every case, Young's modulus decreases linearly with increasing temperature and is expressed by an empirical equation fitted to the data. Differences in Young's modulus values determined from specimens with longitudinal axes parallel and perpendicular to the rolling direction are small, as are the differences between Young's moduli determined from strip, bar stock, and fuel sheathing. Author (NSA)

N76-26324# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.

CREEP AND FATIGUE OF AISI 316 STAINLESS STEEL FOLLOWING EXPOSURE TO LOW (APPROXIMATELY 0.10)

W. Carnock and P. Marshall Apr. 1975 26 p refs
(RD/B/N-3383) Avail: ERDA Depository Libraries HC $4.50

Specimens of AISI 316 stainless steel were subjected to fatigue and creep testing after exposure to sodium of carbon activity approximately 0.1 at 633 C for 800 h. The gradient of predominantly grain boundary carburization extended to the center of the 0.75 mm thick specimens and had the effect of marginally reducing the room temperature fatigue endurance and increasing the elevated temperature (633 C) fatigue endurance. Current models of fatigue behavior indicate that these effects may be attributed respectively to a decrease in cold ductility and an increase in hot tensile strength. The creep strength at 600 C was markedly increased at all stresses within the range 180 to 270 N/sq mm and the creep ductility was marginally reduced. At low stresses, strength increased with time as a result of carbide redistribution while the higher stress strength increases are thought to originate from a dynamic strain aging effect involving a chromium-carbon-dislocation interaction.
Author (NSA)

N76-26325# Battelle Inst., Frankfurt am Main (West Germany).

SOLIDIFICATION OF ALLOYS UNDER ZERO GRAVITY CONDITIONS [ERSTARRUNGSVERHALTEN VON LEGIERUNGEN IM SCHWERELOSEN ZUSTAND]

Dietrich Merz, Krishna Simhan, and Heinrich Winter Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 46 p refs In GERMAN; ENGLISH summary
(Contracts BMFT-RFT-1072; GfW-RV-21-V-12/73)
(BMFT-FB-W-75-23) Avail: NTIS HC $4.00; ZLDI, Munich DM 9,70

The solidification behavior under zero-g conditions of alloys with a miscibility gap was investigated for an aluminum-indium alloy, containing 50 wt.% In. The melt was heated inductively to a temperature of around 1000 C, far above the miscibility gap, which ends at about 800 C. Droplets of the melt were thrown off with a rotating sprayer and solidified in free flight under near zero-g conditions. If the droplets hit cooling surfaces made from copper under a small angle, they solidified rapidly into splat foils. Here the momentary condition of a melt after a definite time of free flight could be fixed. Under near zero-g conditions, the gravity segregation could be avoided. A new metallographic structure was recognized in these specimens.
Author (ESA)

N76-26326# Siemens A.G., Erlangen (West Germany).

SUPERCONDUCTING MATERIALS FOR SHIELDING OF MAGNETIC FIELDS Final Report

Alfred Mueller Bonn . Bundesmin. fuer Forsch. u. Technol. Oct. 1975 31 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-18) Avail: NTIS HC $4.00; ZLDI, Munich DM 6,55

Superconducting sintered materials, containing niobium, tin and small amounts of other elements, for shielding of magnetic fields were studied. Experiments to determine the strength of the magnetic field shielded by the binary material Nb-Sn as a function of the preparation technique and to determine the strength of the shielded field as a function of additions are described. With bismuth an increase in strength of the shielded magnetic field of about 30% was achieved. ESA

N76-26327# Aluminum Co. of America, Alcoa Center, Pa.

DESIGN MECHANICAL PROPERTIES INCLUDING FRACTURE TOUGHNESS AND FATIGUE, FATIGUE CRACK PROPAGATION RATES AND CORROSION CHARACTERISTICS OF ALCLAD 7050-T76 SHEET Final Report, Oct. 1973 - Oct. 1975

J. W. Coursen, G. E. Nordmark, G. T. Sha, and J. D. Walsh Jan. 1976 112 p refs
(Contract N00019-74-C-0065)
(AD-A021121) Avail: NTIS CSCL 11/6

The tensile, compressive, shear, bearing, fracture toughness and axial-stress fatigue properties, fatigue-crack propagation rates and corrosion characteristics have been determined for 10 lots of alclad 7050-T76 sheet ranging from 0.025-in. through 0.249-in. thick. Tables of computed design mechanical properties and individual tensile and compressive stress-strain curves are presented. The effect of stretching on the tensile properties was also studied. Axial-stress fatigue strengths and fatigue-crack propagation rates were determined in ambient-air and salt-fog environments. GRA

N76-26328# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

NOTCHED BEND BEHAVIOR OF BERYLLIUM OVER A WIDE RANGE OF STRAIN RATES Interim Technical Report, Sep. 1973 - Mar. 1975

T. Nicholas Dec. 1975 46 p refs
(AF Proj. 7351)
(AD-A021116; AFML-TR-75-177) Avail: NTIS CSCL 11/6

Three point bend tests on U-notched Charpy specimens were conducted for six grades of beryllium over a range in loading rates from 0.000 001 to 10 m/sec. Load-deflection curves were obtained from tests performed on a servo-controlled hydraulic testing machine at low and intermediate loading rates and with a Hopkinson pressure bar apparatus at high rates. Curves of absorbed energy, maximum load, and maximum deflection against loading velocity indicate a transition velocity for several grades of beryllium at which the ductility of the material decreases sharply. GRA

N76-26329# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

PROCEEDINGS OF THE TRISERVICE CORROSION OF MILITARY EQUIPMENT CONFERENCE. VOLUME 1.2 SESSIONS 1-3 Final Report, 31 Oct. 1974 - 1 Feb. 1975

Fred H. Meyer, Jr. Sep. 1975 549 p refs Conf. held at Dayton, Ohio, 29-31 Oct. 1974
(AF Proj. 7381)
(AD-A021053; AFML-TR-75-42-Vol-1) Avail: NTIS CSCL 11/6

Papers are presented on corrosion of aircraft, rocket and spacecraft components, metals in military equipment, composite materials, chemical attack, stress corrosion, and fuel composition. GRA

N76-26330# Air Force Materials Lab., Wright-Patterson AFB, Ohio.

CRACK PROPAGATION CHARACTERISTICS IN THREE DEEP HARDENABLE TITANIUM ALLOYS Final Technical Report, Aug. 1974 - May 1975

Paul J. Bania Nov. 1975 34 p refs
(AF Proj. 7351)
(AD-A020283; AFML-TR-75-84) Avail: NTIS CSCL 11/6

Tests were conducted on three recently developed deep-hardenable grade titanium alloys in order to assess their crack propagation and stress corrosion behavior. The alloy compositions are as follows: Alloy no. 334 (Ti-10Mo-6Cr-2.5Al); Alloy no. 227 (Ti-7Mo-4Cr-2.5Al); and Alloy no. 253 (Ti-10Mo-8V-2.5Al). Compact tension specimens were cut from 6-inch diameter forging billets in three orientations. Each orientation was subsequently tested for fatigue crack growth rate and stress corrosion susceptibility. While all three alloys exhibited similar fatigue crack propagation characteristics, the chromium containing alloys appeared to be more susceptible to stress corrosion cracking. Scanning electron microscopy of the fracture surfaces revealed the presence of an apparently brittle rod-like phase. While the composition of the rods could not be directly determined, indirect evidence indicated that the rods were titanium borides. These

rods were judged to have a significant effect on the fracture toughness and a lesser effect on the crack propagation properties of the alloys. GRA

N76-26331# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
EROSIVE EFFECTS OF VARIOUS PURE AND COMBUSTION-GENERATED GASES ON METALS, PART 1 Final Report, 1 Jul. 1974 - 30 May 1975
A. C. Alkidas, S. O. Morris, and M. Summerfield Oct. 1975 62 p refs
(Contract DAAG46-72-C-0078; DA Proj. 1T1-61102-A-42)
(AD-A020537) Avail: NTIS CSCL 11/6

This study presents an experimental investigation of the thermal and chemical erosion characteristics of steel alloys under the short exposure of high pressure and high temperature propellant gases (vented-combustor apparatus) and pure gases (ballistic compressor apparatus). In the vented-combustor tests, the erosion experienced by the alloys is shown to increase with decreasing thermal conductivity and specific heat. The established linear dependence of mass eroded on number of firings suggests that any physical alterations undergone by the eroded surface do not influence future erosion tests. Most significantly, erosion results of the steel alloys (of widely differing compositions) in the ballistic compressor show no distinct difference. GRA

N76-26332# Naval Ship Research and Development Center, Bethesda, Md.
MECHANICAL PROPERTIES AND SEAWATER BEHAVIOR OF NITRONIC 50 (22 Cr-13 Ni-5 Mn) PLATE Research and Development Report
I. L. Caplan Jan. 1976 38 p refs
(AD-A020974; DTNSRDC-4554) Avail: NTIS CSCL 11/6

The mechanical properties and seawater behavior of Nitronic 50 (22Cr-13Ni-5Mn) have been investigated. One-inch base plate and gas metal-arc weldments were used for this study. Good elongation and toughness properties were obtained. The yield strength of the weld metal was overmatching (80 versus 63 thousand pounds per square inch). The alloy demonstrated satisfactory stress-corrosion resistance. Base metal, high- and low-cycle fatigue performance was excellent, but gas metal-arc weldments performed poorly because of weld porosity. The corrosion behavior of Nitronic 50 is not adversely affected when coupled to common naval alloys. In most cases, it behaves cathodically and accelerates the corrosion of these alloys. While Nitronic 50 does not display general pitting corrosion, it does evidence crevice corrosion, but to a much lesser degree than most common stainless steels. Author (GRA)

N76-26333# Naval Intelligence Support Center, Washington, D.C. Translation Div.
EXPERIMENTAL IDENTIFICATION OF PLASTIC ZONES IN TITANIUM ALLOY MODELS
Yu. N. Rabotnov and O. F. Stankevich 21 Jan. 1976 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. (Moscow), no. 2, 1965 p 108-109
(AD-A021113; NISC-Trans-3749) Avail: NTIS CSCL 11/6

Commercial titanium is always covered with a very thin surface film which appears very rapidly in air after polishing and can reach a thickness of 50 A in the course of time. The mechanism of the formation of these films on titanium is described. It has been noted that this scale phase composition is obtained at temperatures below 1,100 deg; a temperature below 900 deg, solution of nitrogen in the TiO2 phase is also possible, along with the phenomenon described. The soluble components in the binary alloys TiAl and TiSn accelerate scale formation. It appears that the scale phase composition does not change as a result of the presence of alloying elements. Specimens of 1.2mm thick sheet were tested in order to determine the theoretical possibility of identifying plastic zones in the VT5-1 alloy. Author

N76-26334# Lehigh Univ., Bethlehem, Pa.
THE EFFECT OF MICROCRACKING IN MARTENSITE ON THE DEFORMATION AND FRACTURE BEHAVIOR OF Fe-C ALLOYS AND COMMERCIAL STEELS Final Report, 1 Sep. 1973 - 31 Aug. 1975
George Krauss (Colo. School of Mines) 31 Dec. 1975 8 p refs
(Contract DAHC04-74-G-0021)
(AD-A020494; ARO-11665.3-MC) Avail: NTIS CSCL 11/6

The effect of tempering on microcrack reduction was examined in an Fe-1.22C alloy. The major reduction occurred before transformation of the retained austenite and was attributed to tempering-induced plastic deformation. Fracture toughness of 52100 steel was measured according to ASTM E-399 and a transition from trans to intergranular fracture was noted with increasing austenitizing temperature. Auger-electron analysis showed high C and P present on intergranular fracture surfaces of carburized 8620 steel. GRA

N76-26335# Illinois Univ., Urbana. Dept. of Metallurgy and Mining Engineering.
ION MICROPROBE ANALYSIS FOR NIOBIUM HYDRIDE IN HYDROGEN-EMBRITTLED NIOBIUM
Peter Williams, Charles A. Evans, Jr., Martin L. Grossbeck, and Howard K. Birnbaum Nov. 1975 23 p refs
(Contracts N00014-67-A-0305-0020; AT(11-1)-1198)
(AD-A020287) Avail: NTIS CSCL 11/6

The use of the Ion Microprobe technique for detection of hydrogen and hydrides in niobium is developed. Analytic procedures for quantitative determination of the concentration of hydrogen in the solid solution and in the hydride are presented. These procedures are applied to the detection of stress induced hydrides at cracks in hydrogen embittled Nb. Author (GRA)

N76-26336# General Dynamics/Fort Worth, Tex.
DEVELOPMENT OF A WELDABLE HIGH STRENGTH STEEL Final Report, Mar. 1973 - Feb. 1975
C. D. Little and P. M. Machmeir Wright-Patterson AFB, Ohio AFML Sep. 1975 137 p refs
(Contract F33615-73-C-5093; AF Proj. 7351)
(AD-A021174; AFML-TR-75-148) Avail: NTIS CSCL 11/6

An existing 10Ni-8Co-2Cr-1Mo steel (HY180) was modified to a higher strength level to meet the need for weldable and fracture-resistant high-strength steel alloys required in current and future airframe structural applications. This steel, which relies on the precipitation of a secondary hardening precipitate in a highly dislocated lath martensite matrix at an elevated aging temperature, appeared to be an excellent candidate for modification to meet high toughness requirements at high strength levels (230-250 Ksi UTS). Eight experimental alloys were melted where the level of alloy addition was controlled by factorial and regression analysis techniques. Six of the eight experimental alloys met the mechanical property requirements. The selected alloy composition (14Co-10Ni-2Cr-1Mo-0.16C) was scaled-up to a 2000 lb VIM/VAR heat with no apparent decrease in mechanical properties. Preliminary results indicate low fatigue crack growth rates both in ambient and corrosive environments, improved S/N fatigue and good general corrosion resistance. The 14Co-10Ni-2Cr-1Mo-0.16C steel (AF1410) was found to be quite weldable by conventional arc weld processes. GRA

N76-26337# Cincinnati Univ., Ohio.
A TEST METHOD FOR EVALUATION OF METAL POWDERS Final Report, Nov. 1973 - Mar. 1975
N. Birla and Vincent DePierre Oct. 1975 47 p refs
(Contract F33615-73-C-5097; AF Proj. 7351)
(AD-A020322; AFML-TR-75-171) Avail: NTIS CSCL 11/6

A speedy and economical test method for determining the potential of metal powders to achieve desired mechanical properties after consolidation is described. It consists of encapsulating metal powders in an evacuated metal tube and reducing the outside diameter of the powder-filled tube by swaging to produce a fully consolidated powder bar which provides material for tensile testing. The tensile test results measure the potential of the metal powders. Application of the method to an evaluation of spherical (rep) and angular (H/dh) titanium alloy (Ti-6Al-2Sn-4Zr-6Mo) metal powders demonstrates the procedure can also be utilized to determine processing properties of metal powders. Results show both spherical and angular powders upon complete consolidation furnish tensile properties equivalent to conventional wrought Ti-6246 material. Results also indicate that the hydride powders (1.9% hydrogen) are less apt to be contaminated during processing. The test method is recommended as an excellent tool for determining the potential of metal powders to achieve mechanical properties and for establishing optimum

processing parameters for consolidation of metal powders.
Author (GRA)

N76-26338# Army Materials and Mechanics Research Center, Watertown, Mass.
RESISTANCE OF DIFFUSION-BONDED ELECTROLESS NICKEL-PLATED Ti-5 Al-2.5 Sn ALLOY TO HOT SALT STRESS CORROSION CRACKING Final Report
Anthony K. Wong, Milton Levy, and Joseph L. Morrossi Dec. 1975 27 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A020940; AMMRC-TR-75-26) Avail: NTIS CSCL 11/6

Bent-beam, constant deflection experiments at a temperature of 900 F for time durations up to 1,000 hours indicated that diffusion-bonded (950 F or 1,150 F in vacuum) electroless nickel plate was affected by hot salt stress corrosion (HSSC). However, the protective plate demonstrated potential for reducing the susceptibility of the Ti-5Al-2.5Sn titanium alloy substrate to HSSC cracking. Mechanically induced surface defects (indentations, scratches) in the surface of the plate did not significantly alter the patterns of corrosion attack. Continued in-house efforts to establish failure mechanisms and to optimize plating processes are contingent upon results from further tests to determine erosion and fatigue behavior of these materials at elevated temperature.
GRA

N76-26339# American Univ., Washington, D.C. Dept. of Chemistry.
SCRAPE POTENTIAL MEASUREMENTS ON ALUMINUM ALLOY TYPE 7075 IN NaBr AND NaCl SOLUTIONS
Patricia P. Trzaskoma and R. T. Foley Dec. 1975 33 p refs
(Contract N00014-68-A-0245-0009; NR Proj. 036-106)
(AD-A020195; TR-2) Avail: NTIS CSCL 11/6

Scrape potential measurements were made on aluminum alloy type 7075 in concentrated solutions of NaBr and NaCl. The measured parameters, V sub sc, the scrape potential; V sub ss, the steady state potential; and delta V, the difference between the steady state potential and the scrape potential are a function of the electrolyte and concentration. From the potential-time curve describing the rate at which the potential returns to the steady state, two dV/dt parameters can be distinguished. The first in the millisecond range, is extremely high and is identified with the formation of complexes; the second, lower, is identified with the formation of the passive film. GRA

N76-26340# Watervliet Arsenal, N.Y.
HIGH TEMPERATURE OXIDATION OF AISI 4330 IN CO/CO2 MIXTURES
F. Saegusa Dec. 1975 39 p refs
(AD-A020422; WVT-TR-75065) Avail: NTIS CSCL 11/6

The reaction of the 4330 steel in carbon dioxide-carbon monoxide mixtures has been investigated in the temperature range 800-1300C. The reaction involved decarburization, internal and external oxidation. The kinetics in the decarburization-oxidation processes were determined by the thermogravimetric techniques. The reaction rate was generally represented by the negative parabolic-positive linear relationship. The surface scale was mainly of wustite with duplex structure. The morphological development of wustite scale was examined with respect to the steps in reaction kinetics. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N76-26341 Pittsburgh Univ., Pa.
CREEP AND CREEP RECOVERY BEHAVIOR OF COMMERCIAL POLYSTYRENES AND LOW DENSITY POLYETHYLENES Ph.D. Thesis
Pawan Kumar Agarwal 1975 195 p
Avail: Univ. Microfilms Order No. 76-14100

Creep and creep recovery studies of four commercial polystyrenes and three low density polyethylenes are made using a magnetic bearing torsional instrument. There are significant differences in the processing behavior, within both groups of polymers, in spite of the fact that molecular characterization parameters vary only slightly. In the case of the polystyrenes, reduced recovery curves extending from the glassy region to the terminal steady state region are obtained. The reduced curves and the calculated retardation spectra and other viscoelastic functions are compared with one another and with those of a narrow distribution sample. The differences among the samples are seen in the long time recovery response beyond the rubbery plateau. The steady state recoverable compliance and the length of the rubbery plateau were found to increase with the increase in the molecular weight of the samples. Dissert. Abstr.

N76-26342# National Aeronautical Establishment, Ottawa (Ontario).
NEUTRAL DENSITY PAINT MIXTURES PROVIDING PREDICTABLE DIFFUSE SURFACE REFLECTIVITY FOR VISIBILITY STUDIES
A. A. Ayad Mar. 1976 30 p refs
(MS-137; NRC-15291; ISSN-0077-555X) Avail: NTIS HC $4.00

At present the targets are used in connection with studies in night driving visibility; however, the method presented has a wide range of applications. In the case of visibility experiments, a methodology is developed, allowing for the standardization of reflectance measurements between the various laboratories presently involved in the field. Author

N76-26343*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DEVELOPMENT OF POLYMERIC COATINGS FOR CONTROL OF ELECTRO-OSMOTIC FLOW IN ASTP MA-011 ELECTROPHORESIS TECHNOLOGY EXPERIMENT
William J. Patterson May 1976 63 p refs
(NASA-TM-X-73311) Avail: NTIS HC $4.50 CSCL 11D

The development of a methyl cellulose based coating system for control of electro-osmotic flow at the walls of electrophoresis cells is described. Flight electrophoresis columns were coated with this system, resulting in a flight set of six columns. In flight photography of MA-011 electrophoretic separations verified control of electro-osmotic flow. Author

N76-26344# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
BOND STRESSES IN CIRCULAR PIEZOCERAMIC BENDERS
N. T. Adelman Mar. 1976 16 p refs
(Proj. 161-251)
(TAE-274) Avail: NTIS HC $3.50

An upper bound is obtained for the normal and shear stress distributions acting at the bond interface of circular piezoceramic flexural mode transducers. Results are valid for large thickness/radius ratios due to the nonlinear character of the analysis. Computations for PZT-4 benders indicate that there is little probability for bond failure under normal loading and bonding conditions. Author

N76-26345*# National Aeronautics and Space Administration. Pasadena Office, Calif.
OIL AND FAT ABSORBING POLYMERS Patent Application
Harold E. Marsh, Jr., inventor (to NASA) (JPL) Filed 7 Apr. 1976 18 p
(Contract NAS7-100)
(NASA-Case-NPO-11609-A; US-Patent-Appl-SN-674700) Avail: NTIS HC $3.50 CSCL 07C

A polymer system and resulting method useful for absorbing fats or oils is described which comprises forming a solid, network polymer having a minimal amount of cross-linking. The polymer remains solid at a swelling ratio in oil or fat of at least 10 and thus provides an oil absorption greater than 900 weight percent. NASA

N76-26346# Royal Netherlands Aircraft Factories Fokker, Schiphol-Oost. Space Div.
ESTABLISHMENT OF NON-DESTRUCTIVE INSPECTION TECHNIQUES FOR HONEYCOMB SANDWICHES WITH CARBON-FIBRE COMPOSITE FACE SHEETS BY MEANS

OF HOLOGRAPHIC METHODS. INITIAL STUDY
N. P. Enderberg Paris ESA Dec. 1975 80 p
(Contract ESTEC-1957/73-SK)
(ESA-CR-478) Avail: NTIS HC $5.00

The results of nondestructive tests performed with the Fokker bond tester and the Fokker holographic interference tester and of destructive short-column-compression and flexural tests were evaluated to determine the influence of artificial defects in the carbon-fiber composite face laminates and in the face-to-core bonds of aluminum honeycomb core sandwich panels. Both kinds of tests were able to detect the face-to-core bond defects, but did not succeed so well in detecting the face-laminate defects (the holographic interference method was the most effective in the latter case). The influence of the defects on the results of the destructive tests was scarcely distinguishable from the scatter of the results in the case of the flexural tests and was very small in that of the short column compression tests. The Fokker holographic interference real-time video system was found to be the more effective of the nondestructive systems used in the project. Vibration testing is less effective owing to the high damping of the composite panel. Author (ESA)

N76-26347# Aerospace Corp., El Segundo, Calif. Lab. Operations.
DISTRIBUTION OF LONG CRACKS IN A ONE-DIMENSIONAL MODEL Interim Report
David C. Pridmore-Brown and Richard H. Huddlestone 15 Dec. 1975 23 p refs
(Contract F04701-75-C-0076)
(AD-A019264; TR-0076(9990)-3) Avail: NTIS CSCL 20/11

This report describes work undertaken in an attempt to understand the implications of an idealized model for predicting the fracture of graphite under tension. In this model the graphite is represented as a regular lattice of grains each of which has an equal and independent probability of being cracked under an axial stress. The present study is restricted to a further idealization in which the model is taken to be one-dimensional. Both an exact formula and an asymptotic approximation to it are derived for the probability of occurrence of one or more sequences of contiguous cracked grains of a given size or greater.
Author (GRA)

N76-26348# Alabama Univ., University. Dept. of Chemistry.
ORGANOMETALLIC POLYMERS AND RESINS (EAM TITLE: INORGANIC POLYMERS) Technical Report, 21 Jun. 1974 - 10 Aug. 1975
Charles U. Pittman, Jr. 10 Aug. 1975 150 p refs
(Contract N00014-73-A-0361)
(AD-A019650; SR-2) Avail: NTIS CSCL 07/3

This report summarizes studies of the following topic areas during the period 21 June 1974 through 10 August 1975: (1) Polymerization of organometallic vinyl and other monomers (characterization and vinyl reactivity); (2) Binding of homogeneous organometallic catalysts to polymers (the use of these catalysts to promote organic reactions); (3) Synthesis of semiconducting organometallic polymers (mixed valence state systems); (4) Thermal decomposition of organometal carbonyl polymers. This report consists of preprints and reprints of work published on these topics which were not included in Scientific Report 1 or which were completed since then. GRA

N76-26349# Navy Clothing and Textile Research Unit, Natick, Mass.
LIGHTWEIGHT ALUMINIZED FABRIC AND INSULATION-LINER MATERIALS FOR PROXIMITY FIREFIGHTERS, GARMENTS Technical Report, May 1970 - Dec. 1973
Zelig Kupferman and Norman F. Audet Dec. 1975 36 p refs
(AD-A020963; TR-114) Avail: NTIS CSCL 11/5

The Navy Clothing and Textile Research Unit (NCTRU) has developed a new lightweight aluminized 10.5-ounce fabric made with cor-spun Novatex-Nomex yarns and a removable quilted insulation liner containing needlepunched Nomex felt as a replacement material for the aluminized 20-ounce asbestos-cotton outershell fabric and quilted wool-batt insulation liner currently used in the standard crash-crew proximity firefighter's outfit. The adoption of the new materials will significantly increase the comfort and efficiency of the firefighter by reducing weight and bulk and enhancing flexibility of the protective clothing. Initial laboratory investigation of comparative heat-protective characteristics of lightweight aluminized fabrics and insulation liners supported the final selection of the aluminized 10.5-ounce Novatex-Nomex fabric and quilted insulation liner containing 7-ounce Nomex felt. Analysis of laboratory data on the physical properties of the aluminized Novatex-Nomex material indicated it had excellent potential as a substitute fabric for the current standard material. A small semi-production run was made on both the outershell and the insulation materials and the materials were manufactured into experimental prototype garments. Examination of prototype garments worn for 3 months showed satisfactory durability with no holes, cuts or tears to the outershell fabric nor delamination of the aluminum coating. The quilted Nomex liner laundered satisfactorily with only slight loss in thickness and low shrinkage. Based on these findings, NCTRU recommended the new materials and outfit for adoption to replace the current standard proximity firefighter's ensemble.
Author (GRA)

N76-26350# Boeing Aerospace Co., Seattle, Wash.
CERAMIC AIRFRAME BEARINGS Final Report, Jan. 1974 - Nov. 1975
Jan W. VanWyk 1 Nov. 1975 95 p refs
(Contract N00019-74-C-0264)
(AD-A020170; D180-19181-1) Avail: NTIS CSCL 11/8

A friction and wear screening program was conducted using silicon nitride rider specimens in contact with various ceramic coatings on titanium. A lubricant reservoir bearing surface developed under a previous contract for a solid ceramic surface was evaluated in this program. Three plain spherical bearing designs were fabricated utilizing a 1 3/8 inch diameter silicon nitride ball. The bearing outer race lubricant reservoirs contained an MoS2 solid lubricant compact and a polyolefin expansion material. Two of the bearing designs were tested under conditions simulating use in a helicopter pitch link bearing application. Tests conducted at Sikorsky resulted in bearing failure after 3 and 6.5 hours of operation. Tests at Vertol resulted in one bearing ball fracture after 100.6 hours of test time. The bearing surfaces on the two other Vertol test bearings were in good operating condition after the 100.6 hour test. It was concluded that the ceramic airframe bearing shows promise for future application but that additional development was required. Author (GRA)

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N76-26351*# Thiokol Chemical Corp., Brigham City, Utah. Wasatch Div.
SOLID ROCKET PROPELLANT WASTE DISPOSAL/INGREDIENT RECOVERY STUDY Final Report
Meldon J. McIntosh 4 May 1976 25 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954161A)
(NASA-CR-148195; MER-1374A) Avail: NTIS HC $3.50 CSCL 21I

A comparison of facility and operating costs of alternate methods shows open burning to be the lowest cost incineration method of waste propellant disposal. The selection, development, and implementation of an acceptable alternate is recommended. The recovery of ingredients from waste propellant has the probability of being able to pay its way, and even show a profit, when large consistent quantities of composite propellant are available. Ingredients recovered from space shuttle waste propellant would be worth over $1.5 million. Open and controlled burning are both energy wasteful. Author

N76-26352# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Lampoldshausen (West Germany). Inst. fuer Chemische Raketenantriebe.
PROPELLANT SELECTION FOR RAMJETS WITH SOLID FUEL

Robert H. Schmucker and Hendrik Lips 11 Mar. 1976 33 p refs In GERMAN; ENGLISH summary Report will also be announced as translation
(DLR-FB-76-18) Avail: NTIS HC $4.00; DFVLR, Cologne DM 14,20

Ramjet propulsion using solid propellant for post-boost acceleration of missiles exhibits several favorable properties, brought about by heterogeneous combustion. A simplified theory for calculating the performance of possible propellants classified with respect to maximum fuel-specific impulse, is presented. The optimal choice of fuel, from a system standpoint, must consider volume constraints, and defines the requirements for motor geometry. Author (ESA)

N76-26353# Purdue Univ., Lafayette, Ind. Project SQUID Headquarters.
FLAMMABILITY STUDY OF POLYMER FUELS USING OPPOSED-JET DIFFUSION FLAME TECHNIQUE
Surendra N. Singhal and James S. Tien Nov. 1975 57 p refs Prepared in cooperation with Case Western Reserve Univ.
(Contract N00014-67-A-0226-0005; NR Proj. 098-038)
(AD-A019475; SQUID-TR-CWRU-3-PU) Avail: NTIS CSCL 21/4

Experiments emphasizing the extinction phenomena and the near-limit burning characteristics are performed on polymers, PMMA (Polymethylmethacrylate) and Delrin, using an Opposed-Jet Diffusion Flame apparatus. The measurements include burning rate and peak flame temperature, and the variables are jet velocity and the oxidizer mole fraction. The measurements indicate the burning rate in the near-limit region departs from a power law relationship indicating the importance of finite rate chemical kinetics in this regime. Consistently, the peak flame temperature measurements prior to extinction show a sharp rate of decrease. Extinction does not occur on a sharp boundary in the oxygen mole fraction-jet velocity plane, but rather in a region (its size may depend on the experimental set-up and external disturbances) wherein extinction occurs in a random manner. The extinction statistics suggest that this is due to the quenching sensitivity of the near-limit flame to disturbances. Determination of chemical kinetic data using extinction 'boundary' is likely to have scatters due to the finiteness of the extinction region. It is suggested that matching of the burning rate curve in the near limit regime may give more reliable chemical kinetic data.
Author (GRA)

N76-26354# Thiokol Chemical Corp., Huntsville, Ala.
STEADY-STATE COMBUSTION OF NONMETALLIZED COMPOSITE SOLID PROPELLANT Interim Report, 1 May 1974 - 30 Jun. 1975
R. L. Glick Jul. 1975 79 p refs
(Contract F44620-74-C-0080; AF Proj. 9711)
(AD-A019674; U-75-27; AFOSR-75-1553TR) Avail: NTIS CSCL 21/9

Monodisperse BDP combustion model was extended to nonmetallized propellants with mixed, polydisperse oxidizers by embedding monodisperse model in statistical framework including mixture ratio effects. Basically, polydisperse propellant is 'disassembled and rearranged' to form sequence of monodisperse pseudo-propellants whose rates are computed via monodisperse model. Reassembly provides real propellant's burning rate. Approach provides information pertaining to distribution of regression rates and surface structure among different size oxidizer particles. Preliminary results suggest that significant factor in rate increases wrought by introduction of small oxidizer modes is mixture ratio alternations in larger modes. Hydraulic T-burner analog was constructed and employed to visualize vent flow phenomena. Studies showed that flow enters vent with axial momentum and that momentum is partially transformed to vent into Karman vortex sheet. Fact that flow enters vent with axial momentum invalidates boundary condition of Culick analysis for flow turning gain; 'correct' boundary condition leads to null vent gain. Experimental facts consistent with proof that in formal one-dimensional flow vent gain violates second law of thermodynamics. Logical and consistent way to reduce solid rocket data when pressure-time history is not neutral was derived. Since current techniques are not self-consistent in this situation, these results open door to reclamation of performance data heretofore rejected. Author (GRA)

N76-26355# Naval Surface Weapons Center, White Oak, Md.
VOLUME AND PRESSURE DEPENDENCE OF SOME KINETIC PROCESSES IN EXPLOSIVES
D. J. Pastine, M. J. Kamlet, and S. J. Jacobs 18 Nov. 1975 17 p refs
(RR0240202)
(AD-A020114; NSWC/WOL/TR-75-149) Avail: NTIS CSCL 07/3

Qualitative formulae are developed which describe the volume and pressure dependence of certain kinetic processes thought to occur in explosives. The volume and pressure dependences of the monomolecular, bond breaking, process and of one possible bimolecular reaction process are specifically described and the possible relationship between these processes and explosive phenomena, such as explosion time, is discussed. An additional investigation is made into the possible influence of wall catalyzed reactions on the detonation process. It is concluded that this latter effect is probably unimportant. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N76-26356 California Univ., Santa Cruz.
ELECTRON MOBILITY ON THE SURFACE OF LIQUID HELIUM Ph.D. Thesis
James Franklin McGill 1974 142 p
Avail: Univ. Microfilms Order No. 76-12389

A time of flight measurement is made on electrons moving above the surface of liquid helium. From the resulting data, the temperature dependence of the electron mobility is calculated. The electrons are held on the surface by a perpendicular electric field. This is the first dc surface mobility measurement below 2.0 K and the first data taken with a net perpendicular electric field. From 2.6 K to 2.0 K, the mobility data agree with 3-dimensional vapor measurements of Sanders. From 2.0 K to 1.4 K, the data agree with 2-dimensional kinetic theory for gas atom scattering and with the cyclotron resonance data of Brown and Grimes. From 1.4 K to 1.17 K, the mobility is lower than the prediction based on gas atom scattering, indicating an additional scattering mechanism. At present, the theoretical explanation of this deviation is not clear. Dissert. Abstr.

N76-26357# National Bureau of Standards, Washington, D.C. Center for Fire Research.
ATTACKING THE FIRE PROBLEM: A PLAN FOR ACTION, 1976 EDITION Final Report
Fredric B. Clarke and Deborah Woolf Raisher Jan. 1976 46 p Supersedes COM-75-10520
(PB-249540/6; NBS-Special Pub-416-76; COM-75-10520; LC-75-600088) Avail: NTIS HC $4.00 CSCL 13L

The mission of the Center for Fire Research is to insure the development of the technical base for the standards and specifications needed in support of the National goal to reduce fire losses by 50% over the next generation. A systems approach to accomplish this mission is described. The Center consists of four basic programs in the area of Fire Science and five applied research programs in the area of Fire Safety Engineering. Active participation by staff members in voluntary standards organizations is the principal means of making this technology available for codes and standards needed to reduce the Nation's fire loss.
GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N76-26358 Stanford Univ., Calif.
TECHNIQUES IN DIGITAL SIGNAL PROCESSING Ph.D. Thesis
Madihally Janardhanlyengar Narasimha 1976 123 p
Avail: Univ. Microfilms Order No. 76-13052

Several new methods which are particularly efficient in the hardware implementation of digital signal processing algorithms are considered. Realization of recursive digital filters and spectrum analyzers based on incremental computer techniques is described. A procedure for correcting the filter coefficients in order to eliminate truncation errors and two efficient methods of incorporating multi-bit transfer are also presented. By initially transforming the signal into its Arcsine value, much of the subsequent processing can be easily implemented. Method for obtaining this transformation and its application to several important signal processing problems are discussed. Among these are computation of discrete Fourier transforms and correlation functions, realization of digital filters, modulation and detection of signals, and construction of frequency synthesizers. A solution to the problem of finding a composite modulus for which the number of distinct quadratic residues is small is presented. Applications of this result to chirp filtering and computation of discrete Fourier transforms are discussed. Dissert. Abstr.

N76-26359 Stanford Univ., Calif.
A STUDY OF SPEECH COMPRESSION USING ANALOG TIME DOMAIN SAMPLING TECHNIQUES Ph.D. Thesis
Ian Montrose Bennett 1976 179 p
Avail: Univ. Microfilms Order No. 76-12978

Fourier transform methods were used to establish the correspondence between the quality of the reconstructed compressed speech waveforms and the subjective recognition of compressed speech. For maximum intelligibility, it was shown that the sampling has to be synchronous with the pitch periodicity of the voiced speech waveform. The result of the two psychoacoustic experiments indicated that: (1) the interruption frequency should be equal to the pitch frequency of the voice waveform for the optimum recognition of compression speech, and (2) smoothing of the discontinuities significantly improves the recognition of compressed speech. The optimum smoothing parameters, window width and characteristics function are also obtained from this study. Dissert. Abstr.

N76-26360 Stanford Univ., Calif.
A FREQUENCY-TRACKING DIRECTION-FINDER FOR WHISTLERS AND OTHER VERY LOW FREQUENCY SIGNALS Ph.D. Thesis
Mark Keith Leavitt 1976 177 p
Avail: Univ. Microfilms Order No. 76-13030

An instrument was developed for tracking whistler and very low frequency signal frequency excursions in real time to produce a filtered, quasimonochromatic version of the signal. The voltages induced by the incident wave on two orthogonal loop antennas and a vertical monopole antenna are processed by this method. The filtered signals are then cross-multiplied in a manner analogous to a Poynting vector calculation to obtain a continuous indication of the wave direction of arrival. Operating at fixed frequencies, the direction-finder produced accurate results on VLF transmissions in the 10 to 20 kilohertz range from NAA, NPG, GBR, and the Omega stations. Well defined bearing indications were also obtained for spherics at frequencies in the 1 to 10 kilohertz region. Successful frequency-tracking and direction-finding were demonstrated for a wide variety of whistler-mode signals, including whistlers, chorus, and discrete emissions. The technique was also successfully applied to emissions in the 2 to 7 kilohertz range. Dissert. Abstr.

N76-26361*# Scientific Translation Service, Santa Barbara, Calif.
EFFECT OF THE FORM OF THE AMPLITUDE-FREQUENCY CHARACTERISTIC OF THE RADIOMETRIC SYSTEM ON THE RECORDING OF THE RADIO EMISSION OF LAYERED MEDIA
A. Ye. Popov and Ye. A. Sharkov Washington NASA Jun. 1976 26 p refs Transl. into ENGLISH from Acad. of Sci., Inst. of Space Res. (Moscow), Pr-238, 1975 p 1-26
(Contract NASw-2791)
(NASA-TT-F-17032; PR-238) Avail: NTIS HC $4.00 CSCL 20N

Using as an example the simplest stratified medium, the influence of the width and form of the amplitude-frequency characteristic of a radiometric system on recording ultrahigh frequency radiation of stratified media is investigated. The relation of the recorded emissivity of a stratified medium to the autocorrelation function of the noise output signal of a radiometer is shown. Simple approximate expressions for the recorded emissivity are obtained for the Lorentzian and Gaussian form of AFC. A comparison of the calculations with experiments in provided.

N76-26362*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SHUTTLE SYNTHETIC APERTURE RADAR IMPLEMENTATION STUDY, VOLUME 1
J. G. Mehlis 8 Mar. 1976 317 p refs 2 Vol.
(Contract NAS7-100)
(NASA-CR-147775; JPL-750-73-Vol-1) Avail: NTIS HC $9.75 CSCL 17I

Results of an implementation study for a synthetic aperture radar for the space shuttle orbiter are described. The overall effort was directed toward the determination of the feasibility and usefulness of a multifrequency, multipolarization imaging radar for the shuttle orbiter. The radar is intended for earth resource monitoring as well as oceanographic and marine studies. Author

N76-26363*# RCA Corp., Princeton, N.J. Astro-Electronics Div.
DETAILED DESIGN PACKAGE FOR DESIGN OF A VIDEO SYSTEM PROVIDING OPTIMAL VISUAL INFORMATION FOR CONTROLLING PAYLOAD AND EXPERIMENT OPERATIONS WITH TELEVISION
30 Jun. 1975 116 p
(Contract NAS9-14266)
(NASA-CR-147778) Avail: NTIS HC $5.50 CSCL 17B

A detailed description of a video system for controlling space shuttle payloads and experiments is presented in the preliminary design review and critical design review, first and second engineering design reports respectively, and in the final report submitted jointly with the design package. The material contained in the four subsequent sections of the package contains system descriptions, design data, and specifications for the recommended 2-view system. Section 2 contains diagrams relating to the simulation test configuration of the 2-view system. Section 3 contains descriptions and drawings of the deliverable breadboard equipment. A description of the recommended system is contained in Section 4 with equipment specifications in Section 5. Author

N76-26364# Telecom Australia Research Labs., Melbourne.
A HANDBOOK FOR THE 8.448 Mbit/s DIGITAL MULTIPLEX
J. A. Bylstra and R. Coxhill Sep. 1974 53 p refs
(Rept-6890) Avail: NTIS HC $4.50

To gain experience with digital multiplexes an experimental 8.448 Mbit/s multiplex has been developed. The developed multiplex does not require its inputs to be synchronized, but only requires that its input rates are within a certain tolerance range (plesiochronous multiplexing). Special processing in the multiplex ensures that no information gain or loss (slip) occurs due to the plesiochronous character of the inputs. The type of processing adopted for the prototype multiplex is positive-zero-negative (+/0/-) justification, which offers advantages over the more common positive justification method if the multiplex is to be used with synchronized inputs. Author

N76-26365# Telecom Australia Research Labs., Melbourne.
A PHASE LOCKED LOOP UNIT WITH STORE AND SYNTHESIZER
A. A. R. Townsend Jan. 1975 66 p refs
(Rept-6950) Avail: NTIS HC $4.50

The unit contains a store for storing the level of the oscillator control voltage in case of the loss of reference signal, and a synthesizer for synthesizing major trunk carrier frequencies. Effectively, the unit produces a number of output frequencies which are locked back to the atomic frequency standard via the two-tone frequency distribution system. Author

N76-26366# Canada Inst. for Scientific and Technical Information, Ottawa (Ontario).
ENERGY CHARACTERISTICS OF ANTENNAS LOCATED CLOSE TO AN INTERFACE
L. G. Sodin 1976 17 p refs Transl. into ENGLISH from Antenny (USSR), no. 20, 1974 p 72-84
(NRC/CNR-TT-1873) Avail: NTIS HC $3.50

The relation of all characteristics of a planar antenna to its radiation pattern in the far zone examined for both real and imaginary angles provides a convenient way of calculating the parameters of radiating and receiving systems. This method is used to determine the parameters of antennas located above the semiconducting surface of the ground, and correlations are obtained which are very convenient for calculations and physical interpretations. These correlations are confirmed by experiments (3) and are used to determine the parameters of a number of radiotelescopes. The method is extended to antennas located in a medium with losses, since it offers a number of advantages over the well-known Hansen-Beckerly-Braude method. Furthermore, it is shown how a small generalization permits one to extend the method of analysis of surface antennas to three-dimensional antennas. Author

N76-26367*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
UNBALANCED QUADRIPHASE DEMODULATOR Patent Application
Herbert S. Kobayashi and Sydney P. Bradfield, inventors (to NASA) Filed 3 Jun. 1976 16 p
(NASA-Case-MSC-14840-1; US-Patent-Appl-SN-692414) Avail: NTIS HC $3.50 CSCL 17B

A new and improved apparatus and method for demodulation of quaternary phase shift keyed (QPSK) data, particularly unbalanced QPSK, are described. Phase adjustment of the output of a phase-locked loop local oscillator is used to reduce sensitivity to amplitude variations internal to the demodulator. NASA

N76-26368*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTATION OF SCALAR FAR-FIELD PATTERNS OF LARGE-APERTURE ANTENNAS
Thomas A. OMalley Washington Jun. 1976 22 p refs
(NASA-TM-X-3408; E-8746) Avail: NTIS HC $3.50 CSCL 20N

In computer programs used for evaluating the performance of high-gain antennas, efficient numerical methods for calculating the far-field patterns must be used since the majority of computer time and storage requirements may be attributed to this phase of the program. The numerical method most frequently used is the Fast Fourier Transform (FFT), which computes the far field as the Fourier transform of the field distribution in the antenna aperture. A new numerical method that in many applications is superior to the FFT in terms of reducing computer time and storage requirements is described. Author

N76-26369# JENAER Glaswerk Schott and Gen., Mainz (West Germany). Abteilung Entwicklung Optisches Glas.
DEVELOPMENT OF OPTICAL FIBERS FOR INFORMATION TRANSMISSION Final Report [ENTWICKLUNG VON LICHTLEITFASERN FUER DIE INFORMATIONSUEBERTRAGUNG]
Norbert Neuroth Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 52 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-26) Avail: NTIS HC $4.50; ZLDI, Munich DM 10.95

Low-loss optical glass types were tested for their ability to be used for the drawing of fibers. Some flint glasses, whose chemical compositions, in order to reduce the loss in the 700 to 900 nm range, are systematically varied, appear to be particularly promising. By using raw materials with a higher degree of purity, the contents of coloring contaminations (transition metals) are reduced. With a view to the production of fibers, a number of drawing methods were tested. At a 850 nm wavelength the lowest loss in the glass is 80 dB/km, and it is 100 dB/km in the fiber made out of such glass. The fiber exhibits a large numerical aperture (0.7) and can be bent extensively. To raise the refractive index, fused quartz is doped with a variety of oxides, in which case the losses increase considerably. A fiber with a TiO2-doped core exhibits a total loss of 190 dB/km at 850 nm wavelength. Fibers provided with a fused-quartz core and a Vycor glass sheath have a loss of 120 dB/km at 850 nm, and of 65 to 90 dB/km at 660 nm. All of these types of fibers show small apertures. In the manufacture of gradient fibers homogeneous glass is used from which the fibers are drawn, the gradient being formed by ion exchange within a salt bath. The refractive index profile is shaped like a squared parabola, and the refractive index difference between fiber axis and fiber edge attains 0.003. Author (ESA)

N76-26370# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
ADAPTATION OF THE SAMPLING RATE FOR ADAPTIVE TARGET TRACKING WITH ELECTRONICALLY CONTROLLED RADAR [ANPASSUNG DER ABTASTZEITEN BEI ADAPTIVER ZIELVERFOLGUNG MIT ELEKTRONISCH GESTEUERTEM RADAR]
G. vKeuk Nov. 1974 26 p refs In GERMAN; ENGLISH summary
(Rept-225) Avail: NTIS HC $4.00

An adaptive single target tracking algorithm implemented in an experimental phased array active multi target tracking system is described. Parallel Kalman filtering is proposed to adapt to the different maneuver states. The divergence problem can be solved by using sequential mismatch detection techniques. The sampling rate for target tracking is then adapted to the estimated lack of information in order to guarantee a constant sharpness of the track in space. Especially in the case of phased array radars, the transient behavior and the decision accuracy can be improved by this robust technique. Author (ESA)

N76-26371# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
SUPPRESSION OF INTERFERENCE IN PARTIAL SPECTRAL RANGES [UNTERDRUECKUNG VON STOERSIGNALEN IN SPEKTRALEN TEILBEREICHEN]
R. Klemm Dec. 1974 33 p refs In GERMAN; ENGLISH summary
(Rept-226) Avail: NTIS HC $4.00

The application of the maximum-likelihood-ratio-test to the detection of target signals in interfering background leads to the concept of an adaptive filter for interference suppression followed by a Doppler filter bank for coherent integration of the target signal. The possibility of changing the succession of operations, i.e. first subject echo samples to the discrete Fourier transform (Doppler filter bank) and then suppress interference in the frequency domain, is discussed. Interference suppression in small spectral ranges is discussed for the realization of an adaptive detection system. Author (ESA)

N76-26372# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
APPLICATION OF ORTHOGONAL PROJECTION TO INTERFERENCE SUPPRESSION BY AN ANTENNA ARRAY [DIE ANWENDUNG DER ORTHOGONAL-PROJEKTION ZUR STOERERUNTERDRUECKUNG BEI EINER GRUPPENANTENNE]
W. Buehring Jan. 1975 36 p refs In GERMAN; ENGLISH summary
(Rept-228) Avail: NTIS HC $4.00

It is shown that the method of orthogonal projection results in a suboptimal processing of a phased array system for interferences. The produced effect is shown in examples. Author (ESA)

N76-26373# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
COUPLING EFFECTS AND DIMENSIONING OF V DIPOLES FOR THE ELRA ANTENNAS [VERKOPPLUNGSEFFEKTE UND DIMENSIONIERUNG VON V-DIPOLEN FUER DIE ELRA-ANTENNEN]
C. Baack Apr. 1975 32 p refs In GERMAN; ENGLISH summary
(Rept-231) Avail: NTIS HC $4.00

The coupling properties of V-dipoles used in the electron-

ically controlled radar system are examined and the dipoles dimensioned. Results for transmitter and receiver dipoles are indicated separately. The coupling effects of dually polarized dipoles used in the receiver were also examined. Theoretical results are completed by measurements. Author (ESA)

N76-26374# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.

MODULATION OF HIGH FREQUENCY SATELLITE SIGNALS BY HYDROMAGNETIC WAVES Ph.D. Thesis - Tech. Hochschule Darmstadt, West Ger.

Klaus Riebold 16 Feb. 1976 140 p refs In GERMAN; ENGLISH summary Report will also be announced as translation

(DLR-FB-76-15) Avail: NTIS HC $6.00; DFVLR, Cologne DM 51

The propagation of high-frequency electromagnetic waves in a periodically disturbed ionosphere is discussed. The disturbances are supposed to be hydromagnetic waves of an extremely low frequency as they are connected with magnetic micropulsations. The hydromagnetic waves are treated by means of Maxwell's equations and the equations for the medium. The equations for the high frequency wave propagation now contain interaction terms due to the low-frequency disturbances. The result is a modulation of the high frequency waves. Analytical and numerical examples show that it is essentially a phase modulation that effects the field-components of the high frequency wave. A weak amplitude modulation is also obtained. Author (ESA)

N76-26375# Naval Research Lab., Washington, D.C.

DETECTION RANGES OF LOW ALTITUDE TARGETS OVER THE SEA SURFACE

James K. Hsiao Nov. 1975 34 p refs

(AD-A019114; NRL-MR-3163) Avail: NTIS CSCL 17/9

In this report the computation of the detection range of a low altitude target over a reflecting sea surface is presented. This detection range usually lies within the intermediate region between the interference and diffraction regions. Since computations of signal strength in this region are estimated by interpolation, the results are an approximation. It is recommended that a rigorous solution be pursued. Furthermore, ducting and other anomalous atmospheric conditions are not taken into account. Work along these lines is also recommended. Author (GRA)

N76-26376# Army Electronics Command, Fort Monmouth, N.J.

ADAPTIVE SPEECH MULTIPLEXING TECHNIQUES FOR EFFICIENT SPECTRUM UTILIZATION AND BANDWIDTH COMPRESSION

William A. Scott, Salvatore J. Manno, and Emery J. Messenger Jan. 1976 98 p refs

(DA Proj. 1S7-63707-D-246)

(AD-A020063; ECOM-4384) Avail: NTIS CSCL 17/2

This report investigates the feasibility of adaptive speech multiplexing to improve the channel usage efficiency of military multichannel loop and trunk transmission systems. Three different techniques were contractually developed by the Army's Electronics Command, then extensively tested in the ECOM laboratories. Other techniques are also discussed. Descriptions of the techniques and the test program, as well as the results of the tests, are presented. Author (GRA)

N76-26377# Mitre Corp., Bedford, Mass.

MIDS (MULTIMODE INFORMATION DISTRIBUTION SYSTEM) NETWORK CONTROL AND DIGITAL DATA SUBSYSTEM DESIGNS

H. R. Clark Dec. 1975 99 p refs

(Contract F19628-76-C-0001; AF Proj. 7040)

(AD-A019967; MTR-3061; ESD-TR-75-303) Avail: NTIS CSCL 17/2

The Multimode Information Distribution System (MIDS) is a local area telecommunications system capable of simultaneously handling digital data, video and voice traffic for a multitude of subscribers in a variety of connectivity patterns on wideband media such as coaxial cable. The designs for a MIDS data distribution subsystem and a multimode network control subsystem based on time division multiplexed techniques are described. The use of a novel, adaptive data rate feature provides high-speed service to any terminal as required without dedicating excessive amounts of capacity to particular terminals. These designs are oriented toward maximum use of current microprocessor technology. GRA

N76-26378# Rome Air Development Center, Griffiss AFB, N.Y.

PARAMETER SELECTION FOR THE MUNTNER-WOLF MODEL Final Technical Report

Miles H. Bickelhaupt, Jr. Dec. 1975 98 p refs

(AD-A019825; RADC-TR-75-280) Avail: NTIS CSCL 17/2

This study is concerned with parameter assignment to the Muntner-Wolf model representing error sequence generation by a real channel. The model describes the distribution of the errors in time. A set of 124 troposcatter experiments from Project MALLARD is examined by a specifically developed set of computer routines. Twelve parameters, constants or simple equations, are found representative of all the experiments. An analytical expression for the central statistic used in parameter assignment is developed for the particular modulation system applied in the experiment. For measurable parameter values, it is found to depend only on signal-to-noise ratio and order of diversity. In order to determine the appropriate length of experiment for model building purposes, the experimental variance for the same statistic is developed. It is found to depend on the signal-to-noise ratio, the length of experiment and the RMS fading bandwidth. The entire problem of parameter error development is examined. A conclusion is reached that parameter assignment is practical using computer techniques. GRA

N76-26379# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

A FAR-INFRARED LASER COMMUNICATION SYSTEM USING THE HYDROGEN CYANIDE LASER M.S. Thesis

Gary L. Salisbury Dec. 1975 154 p refs

(AD-A019860; GEO/PH/75-12) Avail: NTIS CSCL 17/2

An analysis is made of a far-infrared laser communication system using the hydrogen cyanide laser. The hydrogen cyanide lasing wavelength of 337 micrometers falls within the 350 micrometers atmospheric window and provides the impetus for a laser communication system. The system components that are examined include the hydrogen cyanide laser, far-infrared detectors, modulators and optical components. Additionally, atmospheric propagation phenomena are examined at 337 micrometers. A comparison is made of a subcarrier direct and heterodyne laser communication system using signal-to-noise ratios as a measure of the system performance. A communication system using this laser is feasible, and current state-of-the-art components may be used to realize such a system. Atmospheric absorption limits low altitude and sea-level communication link ranges to less than approximately 5km. At higher altitudes, laser power, modulator capability, detector practicality and sensitivity and antenna size are the limiting constraints on the system performance. The report contains a 129-item bibliography. GRA

N76-26380# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.

EXPERIMENTAL EVIDENCE OF A STRONG TE-POLARIZED WAVE FROM AN AIRBORNE LF TRANSMITTER Environmental Research Papers

E. A. Lewis 20 Oct. 1975 19 p refs

(AF Proj. 4603)

(AD-A019689; AFCRL-TR-75-0555; AFCRL-ERP-538) Avail: NTIS CSCL 17/2

Qualitative arguments are advanced to show that the nearly horizontal trailing-wire antennas of high-speed, high-altitude aircraft should excite waves of appreciable intensity in the Transverse Electric (TE) polarization. The altitude distribution of these waves should however differ markedly from that of the conventional Transverse Magnetic (TM) waves. To test these ideas, a special balloon receiver-probe was designed and flown. The experimental data provide strong evidence that TE fields from a standard ARC-96 airborne transmitter not only exist, but can be much larger than the associated TM fields at high altitudes. GRA

N76-26381# Air Force Academy, Colo. Frank J. Seiler Research Lab.

FILTERING FOR PRECISION POINTING AND TRACKING WITH APPLICATION FOR AIRCRAFT TO SATELLITE

TRACKING Scientific Interim Report
Robert B. Asher, Robert A. K. Mitchell, and Peter S. Maybeck Nov. 1975 39 p refs
(AF Proj. 7904)
(AD-A019696; SRL-TR-75-0019) Avail: NTIS CSCL 17/9

Many aerospace problems include the requirement for precision pointing and tracking from one accelerating vehicle to another. This paper considers the use of Kalman filtering for a general class of high precision pointing and tracking applications and the application of the general framework to a specific problem. A general framework which contains all known error sources is developed for a particular Kalman filter. With a covariance sensitivity analysis, this framework can be used to determine the performance of a reduced order filter and conduct a hardware requirements analysis and trade off. In particular, the paper addresses the application of the general framework for an aircraft to satellite precision tracking problem. GRA

N76-26382# Radio Corp. of America, Camden, N.J. Communications Systems Div.
CONTRACT EVALUATION REPORT FOR RADIO SET AN/URC-78 (XE-2)/V (EQUIPMENT COMPLIANCE REPORT) URC-D002
Jun. 1975 110 p
(Contract DAAB07-71-C-0182)
(AD-A020013) Avail: NTIS CSCL 17/2

The evaluation report concerns the advanced development feasibility models of the AN/URC-78(XE-2)/V ultra-reliable, lightweight, VHF-FM, radio system. The evaluation presented is based on data taken during the compliance test program. The program included natural and induced environmental tests and full electrical performance tests on all configurations of the equipment. The results of the compliance test program demonstrate the compliance of the equipment with the requirements of the specification with few exceptions. The quantitative data were backed by subjective field tests which demonstrated the communication range, quality of audio, absence of interference, and ease of operation. GRA

N76-26383# Tetra Tech, Inc., Pasadena, Calif.
CURRENTS INDUCED ON AN IMPEDANCE WITHIN A SLOTTED SPHERE Final Report, Jun. - Sep. 1974
R. W. Latham Jul. 1975 51 p refs
(Contract F29601-74-C-0120; DNA Proj. NWED-EB089)
(AD-A019455; AFWL-TR-74-295) Avail: NTIS CSCL 20/14

The current induced in an impedance connecting the two sections of a slotted hollow sphere when an electron is moving in the vicinity is calculated under the quasistatic approximation. Author (GRA)

N76-26384# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
TWO DIMENSIONAL ELECTROMAGNETIC SCATTERING FROM A DIELECTRIC COATED CONDUCTOR M.S. Thesis
Clayton V. Stewart Dec. 1975 67 p refs
(AD-A019814; GE/EE/75-39) Avail: NTIS CSCL 20/14

This thesis deals with electromagnetic scattering from a dielectric coated, conducting cylinder of arbitrary cross section and of infinite length. The incident field is assumed to be a uniform plane wave traveling normal to the axis of the scatterer. The integral equations for the transverse electric case are derived and discretized for numerical solution. The Hadamard principle value is used to handle high order singularities in the integral equations. A computer program RAMCS has been developed to solve for the two dimensional radar cross section for the case of a lossless dielectric coating. The numerical solution is formulated in terms of the method of moments. Results are presented for circular cylindrical scattering bodies. GRA

N76-26385# Ohio State Univ., Columbus. ElectroScience Lab.
CONTROL OF ELECTROMAGNETIC SCATTERING FROM WING PROFILES BY IMPEDANCE LOADING
J. A. Aas L. G. Hanscom Field, Mass. AFCRL Aug. 1975 103 p refs
(Contract F19628-72-C-0203; AF Proj. 5635)
(AD-A019134; ESL-3424-4; AFCRL-TR-75-0463; SR-4) Avail: NTIS CSCL 17/9

A computational technique has been developed to calculate the electromagnetic scattering from two-dimensional wing profiles loaded by impedance strips. These strips are represented by impedance boundary conditions. This report deals with the parallel electric polarization (TM polarization) while a similar study of the perpendicular polarization is contained in Reference (1). The effect of the impedance loading is studied for different shapes and sizes of the wing, and for different angles of incidence. The last part of the report deals with the relation between two- and three-dimensional scattering. Three-dimensional problems may in certain cases be solved at least approximately from the knowledge of the scattered field in two-dimensional problems.Author (GRA)

N76-26386# Office of Telecommunications, Washington, D.C. Policy Support Div.
U. S. INTERNATIONAL TELECOMMUNICATION RATE HISTORY
J. E. Cole, G. W. Arnaud, L. H. Adams, and M. P. Fackelman Nov. 1975 202 p refs Revised
(PB-249009/2; OTR-75-77; OTR-73-25-Rev) Avail: NTIS HC $7.75 CSCL 05C

The report provides a historical compendium of U.S. international telecommunication rates. It is intended to provide: a comprehensive source of rates, the rate component for analysis of potential price elasticity of demand, and a basis for not only examining the causes for past rate changes but also estimating potential rate changes. Brief sections outline the major milestones in international telecommunications, explain how international rates are established, and show the rate trends over the past years for various services for some of the major paths. The international rates are arranged in sections according to the type of carrier: telephone, record, COMSAT, and INTELSAT. GRA

N76-26387# Naval Postgraduate School, Monterey, Calif.
A SPREAD SPECTRUM COMMUNICATIONS SYSTEMS UTILIZING AN UMBRELLA CODE M.S. Thesis
James Alfred Jaques, III Dec. 1975 92 p refs
(AD-A021767) Avail: NTIS CSCL 09/4

A pulse stuffing technique is used to eliminate the silent gaps in the transmission of a particular Spread Spectrum system. Unauthorized listeners now have more difficulty in recovering the message content. A two code device was built using both a pseudorandom maximal length code and a Golay complementary sequence code. The pseudorandom code was used for pulse stuffing an umbrella code and was discarded after a digital matched filter in the receiver. The Golay code was added with a Surface Acoustic Wave dispersive element and removed with a similar device used as a matched filter. Author (GRA)

N76-26388# Naval Postgraduate School, Monterey, Calif.
SURVEY ON MODERN RADAR SIGNAL PROCESSING M.S. Thesis
Joao Paulo Goncalves Barcia Dec. 1975 129 p refs
(AD-A021819) Avail: NTIS CSCL 17/9

The purpose of this thesis is to investigate the state of the art of radar signal design as well as radar signal processors and determine the actual trends in modern radar design. The use of a digital general purpose radar signal processor is discussed. The concepts of ambiguity and autocorrelation function are investigated in regard to radar resolution capabilities. The concept and analytical development of the DFT/FFT is presented. Quantization noise in a digital MTI processor and its effects in the improvement factor are analyzed. Optimization techniques for the response curve of digital MTI processors using staggered PRF are investigated. The SAR concept and analysis as well as techniques to obtain low correlator rates in SAR digital processors are presented. Author (GRA)

N76-26389# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
AN/SRN-19(XN-1) RADIO NAVIGATION SET. VOLUME 1: PRINCIPLES OF OPERATION
R. E. Bateman, R. K. Burek, R. J. Finneran, D. L. Mitchell, and J. R. Norton Sep. 1975 271 p
(Contract N00017-72-C-4401)
(AD-A019220; APL-JHU-TE-1273/1) Avail: NTIS CSCL 17B

The AN/SRN-19(XN-1) Radio Navigation Set was developed to meet the need for a simplified, low-cost navigation set of

moderate accuracy. The SRN-19(XN-1) provides the advantages of the Navy Navigation Satellite System to small vessels of the Navy and to commercial ships for which the existing equipment is too expensive. Ths SRN-19(XN-1) is a single channel (400 MHz), integral Doppler navigation set that is self-contained except for the antenna, preamplifier unit, and an optional printer. The navigation program is permanently programmed on read-only memory chips. Satellite navigation fixes taken by this equipment are used to update continuous dead reckoning positions as obtained from ship's motion data (course and speed) that are input to the set from the ship's gyrocompass and the EM log. Author

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N76-26390 Stanford Univ., Calif.
THE HIGH ENERGY BROADLY TUNABLE COHERENT SOURCE Ph.D. Thesis
Robert Neil Fleming 1976 108 p
Avail: Univ. Microfilms Order No. 76-13001

A broadly tunable coherent source capable of tuning the infrared and visible spectral regions has been envisioned for many years. A tunable source based on a high energy angle tuned LiNbO3 parametric oscillator is described. Included is a discussion of the high energy Nd:YAG oscillator/amplifier pump source which has been line narrowed to a single axial mode of the oscillator cavity and locked on iodine using a new balanced fluorescence technique. Also covered are line narrowing studies on the parametric oscillator which showed that narrow bandwidths and high energies are obtainable using parametric devices. Finally, a new method of generating tunable infrared radiation using mixing in H2 gas is presented. This method shows the potential of covering the middle and far infrared regions with good efficiency and high energy. Dissert. Abstr.

N76-26391 Alabama Univ., University.
A NUMERICAL DIODE MODEL FOR INVESTIGATION OF THERMAL SECOND BREAKDOWN Ph.D. Thesis
Wayne Heath Causey, Jr. 1975 203 p
Avail: Univ. Microfilms Order No. 76-13896

The model features one-dimensional electrical effects and simplified two-dimensional thermal conduction along with thermally dependent semiconductor parameters. Four, coupled, nonlinear, partial differential equations which consist of the hole and electron continuity equations, the Poisson equation and the energy balance equation characterize the model. These equations are solved simultaneously for mobile hole and electron concentrations, electric field, and temperature as functions of time and position. A contact-to-contact transient simulation with realistic terminal boundary conditions and a constant temperature substrate is performed. Investigations with the numerical model have led to several conclusions with respect to thermal second breakdown. It is observed that junction inhomogeneities, current constrictions and variable perturbations, through various mechanisms, are not required to initiate and support thermal second breakdown. Dissert. Abstr.

N76-26392 Pennsylvania Univ., Philadelphia.
OPTIMIZATION OF GLOW DISCHARGE DETECTORS FOR MILLIMETER AND SUBMILLIMETER WAVES Ph.D. Thesis
Alberto Kho Chua 1975 206 p
Avail: Univ. Microfilms Order No. 76-12262

A new enhanced ionization model based on the kinetic theory of gases was developed to explain the detection mechanisms of electromagnetic radiation by glow discharge detectors. This model provides an expression for the responsivity of the detector as a function of discharge parameters and spectral frequency of the incident radiation. In addition, an analysis of the various noise sources operating in the glow discharge was performed yielding an expression for the overall noise voltage of the detector. This noise voltage is obtained in terms of the discharge current, the electron temperature, dc resistance, and other discharge parameters. The above theoretical results provide for the first time a means for optimizing the performance of the gdd for example minimizing the D in the millimeter, submillimeter, infrared, and visible regions of the spectrums. Dissert. Abstr.

N76-26393*# National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD AND APPARATUS FOR AUTOMATIC LOAD SHARING AMONG PARALLELED CONVERTERS Patent Application
Gene W. Wester (JPL) and Colonel W. T. McLyman, inventors (to NASA) (JPL) Filed 10 May 1976 16 p Sponsored by NASA
(NASA-Case-NPO-13832-1; US-Patent-Appl-SN-684809) Avail: NTIS HC $3.50 CSCL 09C

Equalization of current sharing among a plurality of converters connected in parallel between an unregulated power source and a load is achieved by sensing the output current of each converter and effectively averaging the sensed output currents of the converters. Outputs are compared with the output current of each converter, and using any difference between the sensed output current of a converter and the average output current to adjust the output current of the converter through adjustment of voltage regulating means operating in response to a feedback signal applied to all converters for maintaining the output voltage applied to the load equal to a predetermined reference voltage. NASA

N76-26394*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FIELD EFFECT TRANSISTOR AND METHOD OF CONSTRUCTION THEREOF Patent Application
William R. Feltner, inventor (to NASA) Filed 23 Jun. 1976 11 p
(NASA-Case-MFS-23312-1; US-Patent-Appl-SN-699012) Avail: NTIS HC $3.50 CSCL 09A

A field effect transistor and method of making the same are described. A semi-conductor layer is placed on an insulating substrate, and the gate region is separated from source and drain regions of a like conductivity type. The gate region is at its greatest length on its surface closest to the gate electrode. This is accomplished by initially creating a relatively large gate region of one polarity, and then reversing the polarity of a central portion of this gate region by ion bombardment, thus achieving a narrower final gate region of the stated configuration. NASA

N76-26395# Oak Ridge National Lab., Tenn.
EXPERIMENT TO MEASURE THE EFFECTS OF BIAXIAL STRAIN ON THE CRITICAL CURRENT OF NbTi SUPERCONDUCTOR
K. J. Froelich 1975 4 p refs Presented at the Sixth IEEE Symp. on Eng. Probl. of Fusion Res., San Diego, Calif. 17 Nov. 1975 Sponsored by ERDA
(CONF-751125-36) Avail: NTIS HC $4.50

Twisted multifilament, copper-clad NbTi superconductors have been axially and biaxially strained at 4.2K with a 7.5T background field. A simply constructed cryogenic loading frame was built and used to strain the conductor. Results on 1.27 mm x 3.13 mm conductor have shown that degradation of less than .3 percent of critical current occurred when the wire was biaxially strained to +3260 micro epsilon in the axial direction and -1875 micro epsilon in the transverse direction. Degradation approaches 3 percent of critical current at approximately 6000 micro epsilon in the axial direction only. Author (ERA)

N76-26396# Siemens A.G., Erlangen (West Germany).
TECHNOLOGY OF STABLE JOSEPHSON JUNCTIONS Final Report
Heinrich Diepers, Bernhard Hillenbrand, Reinhard Kress, Herbert Mai, Otto Schmidt, Karl Schuster, Yilmaz Uzel, and Karl Wohlleben Bonn Bundesmin. fuer Forsch. u. Technol. Oct. 1975 141 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-23) Avail: NTIS HC $6.00; ZLDI, Munich DM 29.65

For the fabrication of Josephson tunnel junctions and microbridges, different material combinations, configurations, and preparation techniques were examined. The best results were obtained with Nb/Nb oxide/Pb junctions produced by ultrahigh vacuum evaporation and with an oxide layer formed by DC plasma oxidation. Junctions with RF anodized or barriers yielded good tunneling characteristics, but the reproducibility was still unsatisfactory. For the fabrication of Nb microbridges, the electron beam exposure technique has proved most successful.
Author (ESA)

N76-26397# AEG-Telefunken AG, Belecke (West Germany). Fachgebiet Leistungshalbleiter.
INVESTIGATION ON SPECIAL IMPURITIES IN SILICON Final Report [UNTERSUCHUNG SPEZIELLER STOERSUBSTANZEN IM SILIZIUM]
Karl Heinz Sommer Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 80 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-31) Avail: NTIS HC $5.00; ZLDI, Munich DM 16.80

The diffusion and doping properties of sulfur and selenium in silicon are dealt with. New applications of these impurities in silicon power device technology were investigated. The minority carrier lifetime in the device is not affected by S- and Se-donors. Hence both elements can be used for the fabrication of a homogeneous conductivity doping of the weakly n-type base by a diffusion step. Technological details of the diffusion process are described. Triple-diffused thyristors with S-doped n-type base and Se-doped power diodes with high blocking voltages were fabricated. Oxide-masking is effective during S- and Se-diffusions. A way to produce thyristors protected against di/dt-failure in the case of anode-triggering is shown. Author (ESA)

N76-26398# Siemens A.G., Munich (West Germany).
FERRO- AND FERRIMAGNETIC SEMICONDUCTORS AND ISOLATORS Final Report [FERRO- UND FERRIMAGNETISCHE HALBLEITER UND ISOLATOREN]
Ernst Feldtkeller, Hans Pink, Peter Tischer, Keith G. Barraclough, Eberhard Bayer, Herbert Goebel, Walter Lugscheider, Andreas Meyer, Helwig Schaefer, Willibald Treitinger et al Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 119 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-T-75-32) Avail: NTIS HC $5.50; ZLDI, Munich DM 25

Preparation of the following substances is described: the binary europiumchalcogenides, the ternary chromiumsulfo- and chromiumselenospinels in pure, substituted, and doped form, and the compounds $EuCr_2X_4$ (X = S,Se) and $EuLn_2S_4$ (Ln = rare earth element). The electric, magnetic and especially the magnetoelectric properties of these materials were investigated. Samples were prepared as thin films, hot pressed powders, or single crystals. Possible technical applications of these materials on the basis of an influence of a magnetic field on the electrical conductivity or on the optical absorption edge do not seem to be very promising. The magnetically controlled switching and the changing of the magnetization via the numbers of the free charge carriers may be suitable for some technical applications.
Author (ESA)

N76-26399# California Univ., Berkeley. Dept. of Engineering.
RESEARCH ON SUPERCONDUCTING SIGNAL PROCESSING DEVICES Final Technical Report
T. Van Duzer 1975 32 p refs
(Grant AF-AFOSR-2113-71; AF Proj. 6813)
(AD-A019672; AFOSR-75-1664TR) Avail: NTIS CSCL 20/3

The role of alloying elements in lead thin films for use as Josephson junctions was examined and thermally cyclable devices were made. Elements which strongly inhibit the movement of grain boundaries and thus prevent the growth of hillocks and whiskers on the film which would puncture the thin oxide barrier were determined. A new technology in which thin silicon membranes supported by a surrounding frame are used for device fabrication was developed. This includes a double-etching scheme to achieve even submicron size membranes having thickness of no more than a few hundred angstroms. Advantages of fabricating Schottky and super-Schottky diodes on such membranes are discussed. Josephson junctions made this way show promise of great design flexibility and may develop into the best Josephson device for mixing and detection. Advantages of the semiconductor barrier analyzed as a possible Josephson junction switching element include a lower Q for the junction cavity. Two orders of magnitude improvement are achieved over oxide barrier junctions. GRA

N76-26400# Epsco Labs., Wilton, Conn.
DESIGN AND DEVELOPMENT OF AN ADVANCED ELECTRON BEAM CONTROL SYSTEM
Jack E. Turek Oct. 1975 45 p
(Contract DAAK02-74-C-0410)
(AD-A019296; ETL-0032; Rept-5078) Avail: NTIS CSCL 14/3

The prime objective of this program was to expand the overall capabilities of an Electron Beam Recorder Micromap Control System. This was achieved through the development of three software packages, and the procurement of additional hardware to improve the present control system and provide a base for a more self-contained system. Three tasks which are fundamental to a micromap system, namely Font Tape Generation, Character Editing, and Text Tape Generation, can now be performed on the existing system. This eliminates the need to use larger off-line computers to perform these basic functions. This report describes the existing EBR Micromap Control System including both newly-purchased hardware and a detailed description of the three software packages developed under this program. GRA

N76-26401# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DIPOLE TRANSIENT RADIATION M.S. Thesis
Charles A. Boyer Dec. 1975 61 p refs
(AD-A019845; GE/EE/75-16) Avail: NTIS CSCL 14/2

The radiated fields of an electromagnetic pulse (EMP) simulator are of interest for various reasons, the most obvious being that of surveillance. The thesis represents the first in a group of proposed studies that will estimate the radiated fields of various EMP simulators based on thin wire modeling of the structure. It lays the tutorial ground work for future analyses by a simultaneous development of the time and frequency domain integral equations, and presents an efficient scheme for direct computation of the time domain response of the structure. The numerical procedures thus developed are applied to the transient analysis of a linear dipole, to demonstrate the validity of the method. The technique can be readily adapted to the analysis of arbitrarily oriented wire structures with lumped loading. GRA

N76-26402# Naval Civil Engineering Lab., Port Hueneme, Calif.
FEASIBILITY OF USING ALUMINUM CONDUCTOR CABLES FOR SHORE-TO-SHIP ELECTRICAL POWER SERVICE Final Report, Jul. 1974 - Sep. 1975
David E. Weems Jan. 1976 17 p refs
(AD-A021844; CEL-TN-1421) Avail: NTIS CSCL 09/1

Electrical power is currently supplied to ships while in port by cable with three copper conductors. At 6 pounds per foot, such cable weighs 600 pounds or more. The Civil Engineering Laboratory conducted a feasibility study to determine if aluminum, rather than copper, could be used as the conductor and thus reduce the weight of the cable. Results of the study indicate that aluminum conductors would cause more problem than would be solved by their use: increased cross section area, reduced flexibility, increased rate of fatigue, and increased susceptibility to corrosion. In addition, the aluminum conductor cable manufacturers contacted indicated their reluctance to produce a cable with the number of fine aluminum strands required. Another part of the study was to determine whether increased cable size would reduce the surface temperature of the cable to enable personnel to handle it without burning their hands. Though a slight reduction was possible by increasing the size of the conductor, the largest temperature changes would result from eliminating direct exposure of the cable to the sun. GRA

N76-26403# Office of Naval Research, London (England).
ELECTRICAL BREAKDOWN ON INSULATING SURFACES
Thomas A. Kitchens, Jr. 20 Jan. 1976 9 p Presented at a

Colloq. held at London, 6 Nov. 1975
(AD-A021853; ONRL-C-1-76) Avail: NTIS CSCL 20/3

A one-day colloquium on electrical breakdown on insulating surfaces was held by the Institution of Electrical Engineers in London on 6 November 1975. Three introductory talks and a half dozen contributed papers were given summarizing the state of the knowledge of electrical breakdown in practical systems and some recent research on various aspects of the subject.
Author (GRA)

N76-26404# Naval Postgraduate School, Monterey, Calif.
A STUDY OF A DIELECTRIC BACKED RESONANT SLOT ANTENNA M.S. Thesis
Uwe Siegfried Kahre Dec. 1975 53 p refs
(AD-A021761) Avail: NTIS CSCL 09/5

This thesis describes a study of a dielectric backed resonant slot antenna. E-field and radiation resistance were calculated and compared with measurements. Special effort was devoted to impedance matching between the transition from the coaxial cable to the slot. The effect of this matching on radiation patterns was discussed and the bandwidth of the antenna measured.
Author (GRA)

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N76-26405 British Library Lending Div., Boston Spa (England).
MEASUREMENT OF VELOCITY TRANSIENTS IN SINGLE PHASE FLOW
J. Mueller-Roos Aug. 1975 12 p refs Transl. into ENGLISH of report from Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Hamburg, 1975
(BLL-WH-Trans-371-(9091.9F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Detection of velocity transients in single phase flow is reported. Periodic temperature signals are impressed on the flow from which correlation over a half period transit times may be calculated. This evaluation is effected after digitalization offline on a large computer. Velocity peaks of over 100% within 1.9 s were represented qualitatively and quantitatively. Author

N76-26406 Stanford Univ., Calif.
TURBULENT HEAT AND MOMENTUM TRANSFER AT AN AIR-WATER INTERFACE: THE INFLUENCE OF SURFACE CONDITIONS Ph.D. Thesis
Dave Anthony McIntosh 1976 232 p
Avail: Univ. Microfilms Order No. 76-13042

The role of the interfacial conditions on the heat and momentum transfer was studied. Four variations of the interfacial conditions were employed. Auto-spectral analysis of the relevant variables demonstrated that the major influence of the oscillating boundary was present in the vertical velocity component. Only in the case of the steeper mechanically-generated wave was the surface mobility influence reflected in all the spectra. A comparison of the horizontal velocity and temperature spectra showed that the temperature variance was composed of higher frequency components than was the horizontal velocity variance. In all cases the spectra exhibited a zone in which the spectral power decayed in accordance with the Kolmogorov -5/3 power law. Estimates of the Kolmogorov universal constants resulted in values of approximately 0.54 for the horizontal velocity spectrum and approximately 1.56 for the temperature spectrum. An examination of the cospectra revealed that the heat transfer was characterized by higher frequency contributions (smaller eddies) than was the momentum transfer. Dissert. Abstr.

N76-26407 Pennsylvania Univ., Philadelphia.
A STUDY OF GAS-SOLIDS SLUG FLOW Ph.D. Thesis
Norman Edward Collins, Jr. 1975 392 p
Avail: Univ. Microfilms Order No. 76-12263

In an attempt to gain insight into the relationship between slug formation in gas-solids flow and turbulence, the literature on turbulent shear flow was reviewed. Experimental data were obtained (using a hot wire anemometer) in order to evaluate the impact of axial location and inlet conditions on the turbulent parameters: longitudinal intensity, mean velocity and pressure drop. Statistically significant changes were observed in the longitudinal intensity after the velocity distribution and pressure drop stabilized. It was also found that the magnitude of the longitudinal intensity was influenced by the length of the pipe. These data were used to determine the start of fully developed turbulent flow. Several protuberances were used to simulate a settled mass or discrete slug in fully developed turbulent pipe flow. Dissert. Abstr.

N76-26408 Iowa Univ., Iowa City.
LONGITUDINAL MIXING OF HEATED WATER IN OPEN-CHANNEL FLOW Ph.D. Thesis
Jost Grimm-Strele 1975 160 p
Avail: Univ. Microfilms Order No. 76-13387

The longitudinal dispersion of heated water in an open channel, with the initial condition of an instantaneous plane source, uniformly distributed over the cross section, was investigated experimentally in a laboratory flume. Extensive measurements of the time-varying temperature field were taken downstream from the source. These data were analyzed mainly in terms of the first three moments with respect to time. The spatial distribution of the moments is shown and then particular attention is given to the growth rate of the variance of the cross-sectionally averaged temperature. Three-dimensional effects are found to be important. Due to velocity variations in the lateral direction, the dispersion coefficient for the ambient flow was increased almost threefold over the theoretical value for a two-dimensional flow with a logarithmic velocity distribution. Dissert. Abstr.

N76-26409 Iowa Univ., Iowa City.
AN EXPERIMENTAL AND ANALYTICAL STUDY OF SURFACE-ROUGHNESS EFFECTS ON THE MEAN FLOW PAST CIRCULAR CYLINDERS Ph.D. Thesis
Oktay Gueven 1975 195 p
Avail: Univ. Microfilms Order No. 76-13388

An experimental and analytical study of the effects of surface roughness on the mean-pressure distribution and boundary-layer development on a circular cylinder in a uniform stream is presented. Experiments were performed with five different sizes of distributed roughness and with several configurations and sizes of rectangular meridional ribs over a Reynolds number range from 70,000 to 550,000. Measurements were also made on a smooth cylinder for comparison. An analytical framework was developed to elucidate the physical mechanisms behind the observed roughness effects and to support the experimental observations. Detailed boundary-layer calculations were performed, and an earlier theory for smooth-wall boundary-layer separation was extended to the case of circular cylinders with distributed surface roughness. In addition, a boundary-layer transition criterion, which takes into account the combined effect of distributed roughness and freestream turbulence was proposed.
Dissert. Abstr.

N76-26410 Colorado State Univ., Fort Collins.
THE DEVELOPMENT OF TURBULENT BOUNDARY LAYERS IN OPEN-CHANNEL FLOW Ph.D. Thesis
Wen-Sheng Liang 1975 187 p
Avail: Univ. Microfilms Order No. 76-13647

The characteristics of the mean flow field and turbulence in the developing and fully developed regions in rough boundary open-channel flow are investigated. The velocity distributions, development of the boundary layer, boundary layer parameters, wall shear stress, turbulence intensity, turbulence scales, and one-dimensional energy spectra are studied. A comparison between flows with and without gravity effect is also included. It was found that the power law velocity profile is a better approximation than the logarithmic law to describe the velocity distribution in the outer region of a boundary layer in open-channel flow. The velocity distributions in a boundary layer in open-channel flow with rough boundary are similar. The development of the wall shear stress may be calculated from

the distributions of the velocities and the velocity fluctuations at water surface. Dissert. Abstr.

N76-26411 Auburn Univ., Ala.
DEVELOPMENT OF RADIATIVE HEAT TRANSFER ANALYSIS FOR ABSORBING, EMITTING, AND AXISYMMETRICALLY SCATTERING MEDIA-APPLICATION OF THIS ANALYSIS TO BOUNDARY LAYER FLOW Ph.D. Thesis
Dharendra Yog Goswami 1975 176 p
Avail: Univ. Microfilms Order No. 76-10897

A nonconvectional method was developed for the solution of radiative heat transfer equations through absorbing, emitting and scattering media using an effective absorptivity in the presence of scattering. An expression was developed for the effective absorptivity of a layer of the medium which includes the effect of absorption, emission and scattering. This method is used in the evaluation of radiative heat transfer in turbulent boundary layer flows over a flat plate. The radiative heat transfer results have also been obtained by solving general radiative transfer equations. It is shown that the method is more efficient than the method of solving general heat radiation equations. Results show that presence of scattering increases the temperatures in the boundary layer. The radiative heat transfer at the wall is decreased in the presence of scattering. There is no significant effect of scattering on temperature gradients near the wall and the convective heat transfer at the wall. Dissert. Abstr.

N76-26412 Florida Univ., Gainesville.
LAGRANGIAN ASPECTS OF TURBULENT TRANSPORT IN PIPE FLOW Ph.D. Thesis
David Lee Breton 1975 217 p
Avail: Univ. Microfilms Order No. 76-12047

A Lagrangian analysis of the turbulent dispersion process was examined by observing the motion of suspended particles in a turbulent flowing liquid. The liquid, trichloroethylene, was pressure-driven through a 0.0254 meter (1 inch) I.D. glass pipe. A photographing technique was developed which enabled the photographing of particle motion over large distances. Particle positions in time were computed from the photographic images. Lagrangian time correlations were computed from the displacement and velocity deviations obtained from the particle trajectories. The time dependence of the various correlations was obvious from an examination of the plotted results. The effect of a confining wall on the radial spread of the particles was apparent for large times. It appeared that the assumption of a constant radial eddy diffusivity coefficient could be used as a fair approximation of the time-dependent coefficient. Dissert. Abstr.

N76-26413 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A NUMERICAL ANALYSIS OF TURBULENT FLOW ALONG AN ABRUPTLY ROTATED CYLINDER Ph.D. Thesis
Felix Aguilar 1976 278 p
Avail: Univ. Microfilms Order No. 76-13507

The turbulent, incompressible flow of a fluid along a stationary cylinder fitted with a rotating aft section was studied. The mean flow was found to be steady and characterized by axial symmetry and abrupt skewing of the boundary layer. The equations of mean motion were closed with the assumption of a scalar eddy viscosity model. Upon reduction to a system of parabolic type, the governing equations were solved by an implicit, finite difference marching technique. The analysis was compared with experimental data obtained for values of the ratio of cylinder circumferential speed to free stream speed of 0.936 and 1.800. The analysis predicted the overall behavior of the three-dimensional flow well. Predicted components of wall shear stress agreed with the experimental values within the uncertainty associated with the experiment. However, comparison of the predicted and measured Reynolds stress distributions revealed that the assumption of a scalar eddy viscosity is not strictly valid.
Dissert. Abstr.

N76-26414 Illinois Inst. of Tech., Chicago.
HIGH PRESSURE FLUID TRANSIENTS FOR HIGH SPEED UNSTEADY WATER JETS Ph.D. Thesis
Harshad Rasiklal Parikh 1975 163 p
Avail: Univ. Microfilms Order No. 76-13151

High pressure fluid transients were studied in a pipe terminating with a nozzle to produce high speed water jets. Such unsteady high pressure jets have applications in rock excavation tunneling and mining. The purpose of this study is to optimally choose the parameters and variables such that high amplification of pressure surges can be obtained at the nozzle exit. Periodic oscillations are superimposed on the steady-state flow at the pressure of 70,000 to 150,000 psi. Effect of pipe length, pipe diameter, ratio of pipe to nozzle diameter, pressure, etc. is investigated on the natural frequency and the amplification. It is assumed that fluid is Newtonian. However, the equation of state reflects the variation in density and bulk modulus with pressure. The flow is turbulent, and eddy viscosity is employed. Two space dimensional equations are solved by a perturbation method considering a periodic solution consisting of the fundamental and higher harmonic oscillations. Dissert. Abstr.

N76-26415 California Inst. of Tech., Pasadena.
MECHANICS OF FLOWING GRANULAR MEDIA Ph.D. Thesis
James Charles Pearce 1975 189 p
Avail: Univ. Microfilms Order No. 76-13136

The flow of a frictional, cohesive solid through plane converging channels with Coulomb friction acting along the channel walls was investigated. The constitutive postulates used in the development of the solution are discussed and the solution is compared with those obtained by earlier investigators. Velocity profiles, mass flow rates, and mean stress distributions along the channel walls predicted by the analysis are compared with experimental results. The solution correctly predicts the trend of the mass flow rate as a function of the channel opening angle as well as the magnitude of mass flow rate in terms of the flow parameters. The solution also gives an accurate measure of the mean stress acting along the channel walls. The problem of predicting the size of the cavity formed below a cylinder in the transverse flow of a frictional, cohesionless material is investigated experimentally. A correlation which gives the lower separation angle as a function of the flow parameters was determined. Dissert. Abstr.

N76-26416 Tulane Univ., New Orleans, La.
AXISYMMETRIC TURBULENT JET STIRRING OF AN INCOMPRESSIBLE FLUID ISSUING INTO A DEAD END VESSEL Ph.D. Thesis
Warren Nichols White, Sr. 1975 273 p
Avail: Univ. Microfilms Order No. 76-13608

The development and decay of the jet were studied. The vessel diameter was about 30 cm, and the vessel height, namely the distance between the horizontal nozzle plane and the dead-end, was 7.5, 10, 15, or 30 cm. Nozzle diameters were 3.2, 5.6, and 7.9 mm. The fluid, water, kept at 25 C, returned to the motive seat through an annular opening in the nozzle plane. Mean velocity was measured with a conical hot film anemometer sensor calibrated in the potential core of the jet. Profiles were determined for nozzle Reynolds numbers of 8,000, 10,200, and 16,900 and at a number of levels depending on vessel height. Results may be qualitatively generalized by comparing the behavior of the confined jet with that of the classical round jet issuing into a semi-infinite domain, disparities being ascribed to the influences of the confining walls. The dimensionless velocity profiles assume a fairly classical form and retain similarity beyond 10 nozzle diameters axial distance up to a short distance from the dead end. Dissert. Abstr.

N76-26417 City Univ. of New York.
THERMAL TURBULENT JETS Ph.D. Thesis
Andrew Henry Warren 1976 170 p
Avail: Univ. Microfilms Order No. 76-13532

Thermal turbulent discharges are investigated. Numerical solutions are presented for two-dimensional time dependent jets. The governing equations are developed for a general three-dimensional, time dependent case. Equations of continuity, momentum, energy and turbulent intensity together with expressions evaluating eddy viscosity and mean square turbulent vorticity are formulated. Turbulent flow expressions are derived from an analysis of turbulent energy spectrum in the wave number space and with assumption of isotropic turbulence. Boussinesq approximation for the buoyancy force is applied. The equations are written in the finite difference form, and the solutions are obtained through an explicit integration scheme with successive

over-relaxation iteration method for the solution of the Poisson equation for the potential function on each time step. Free surface problems are investigated although the solution may also be applied to open space problems. Dissert. Abstr.

N76-26418 Montana State Univ., Missoula.
NATURAL CONVECTION HEAT TRANSFER BETWEEN BODIES AND THEIR ENCLOSURES Ph.D. Thesis
Robert ONeil Warrington, Jr. 1975 218 p
Avail: Univ. Microfilms Order No. 76-13308

Natural convection heat transfer between concentrically located isothermal spherical, cylindrical, and cubical inner bodies and their isothermal cubical enclosure (with air, water, 20 cs silicone oil, and glycerin in the test space) was experimentally investigated. Comparisons were made with the existing data for these same inner bodies and a spherical enclosure. In addition, temperature distributions and flow visualization data were obtained for most of these geometries. Temperature profiles were taken at five angular positions (Theta = 0 deg, 34 deg, 80 deg, 120 deg, 160 deg) and in two vertical planes. The form of the dimensionless temperature profiles were practically invariant with changes in inner body, outer body, and vertical plane. An increase in the Prandtl number increased the magnitude of the dimensionless temperature and also increased the magnitude and extent of the temperature inversions. The ordering of the temperature profiles changed with increased G/R sub i and delta T.
Dissert. Abstr.

N76-26419 Illinois Inst. of Tech., Chicago.
THE INTERFACIAL VISCOELASTIC PROPERTIES FROM LONGITUDINAL WAVE MEASUREMENTS Ph.D. Thesis
Hansraj Champshi Maru 1975 255 p
Avail: Univ. Microfilms Order No. 76-13163

A longitudinal wave technique combined with tracer particle measurements has been applied to measure interfacial dilational viscoelasticity of decanoic acid solutions - representing an adsorbed monolayer system; and of stearic acid films - representing a deposited monolayer system. A significant observation from the measurements on stearic acid monolayers in the range of 35 to 45 A squared/molecule was that the dilational surface viscosity of these monolayers was 15 to 400 times greater than the corresponding shear viscosity. This experimental evidence indicates the extent of the importance of dilational properties in comparison with shear properties. Dissert. Abstr.

N76-26420*# Illinois Univ., Chicago. Dept. of Energy Engineering.
DIFFUSIVITY IN TURBULENT FLUID CONTAINING TWO DOMINANT SCALES, AND COMPRESSIBLE SHEAR LAYER ACCORDING TO A KINETIC THEORY
Paul M. Chung Jun. 1976 36 p refs
(Grant NsG-1150)
(NASA-CR-148146; TRE-76-1) Avail: NTIS HC $4.00 CSCL 20D

The solution of the two nonequilibrium-degree kinetic equation was first determined for the effective length scale and turbulence energy for a spatially homogeneous turbulence field with two characteristic length scales, where the source for one family of eddies exists. This solution was applied to the evaluation of the eddy diffusivity in the combustion chamber of an internal combustion engine. The result was compared with another existing solution. This was carried out to demonstrate the feasibility of obtaining an effective length-scale equation within the context of the kinetic theory. A formulation and partial solution of the compressible plane shear layer are also presented. Author

N76-26421*# Dynatherm Corp., Cockeysville, Md.
HEAT PIPE HEAT REJECTION SYSTEM Final Report
Edward Kroliczek 1976 53 p ref
(Contract NAS5-21523)
(NASA-CR-144763; DTM-71-3) Avail: NTIS HC $4.50 CSCL 20M

A prototype of a battery heat rejection system was developed which uses heat pipes for more efficient heat removal and for temperature control of the cells. The package consists of five thermal mock-ups of 100 amp-hr prismatic cells. Highly conductive spacers fabricated from honeycomb panels into which heat pipes are embedded transport the heat generated by the cells to the edge of the battery. From there it can be either rejected directly to a cold plate or the heat flow can be controlled by means of two variable conductance heat pipes. The thermal resistance between the interior of the cells and the directly attached cold plate was measured to be 0.08 F/Watt for the 5-cell battery. Compared to a conductive aluminum spacer of equal weight the honeycomb/heat pipe spacer has approximately one-fifth of the thermal resistance. In addition, the honeycomb/heat pipe spacer virtually eliminates temperature gradients along the cells.
Author

N76-26422*# Old Dominion Univ. Research Foundation, Norfolk, Va.
A BLOCK ITERATIVE FINITE ELEMENT ALGORITHM FOR NUMERICAL SOLUTION OF THE STEADY-STATE, COMPRESSIBLE NAVIER-STOKES EQUATIONS
Charlie H. Cooke Jul. 1976 34 p refs
(Grant NsG-1098)
(NASA-CR-148276) Avail: NTIS HC $4.00 CSCL 20D

An iterative method for numerically solving the time independent Navier-Stokes equations for viscous compressible flows is presented. The method is based upon partial application of the Gauss-Seidel principle in block form to the systems of nonlinear algebraic equations which arise in construction of finite element (Galerkin) models approximating solutions of fluid dynamic problems. The C deg-cubic element on triangles is employed for function approximation. Computational results for a free shear flow at Re = 1,000 indicate significant achievement of economy in iterative convergence rate over finite element and finite difference models which employ the customary time dependent equations and asymptotic time marching procedure to steady solution. Numerical results are in excellent agreement with those obtained for the same test problem employing time marching finite element and finite difference solution techniques. Author

N76-26423*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
NUMERICAL SIMULATION OF LOW GRAVITY DRAINING Final Report
G. D. Bizzell and G. E. Crane May 1976 145 p refs
(Contract NAS3-17798)
(NASA-CR-135004; LMSC-D52181) Avail: NTIS HC $6.00 CSCL 20D

A boundary value problem was solved numerically for a liquid that is assumed to be inviscid and incompressible, having a motion that is irrotational and axisymmetric, and having a constant (5 degrees) solid-liquid contact angle. The avoidance of excessive mesh distortion, encountered with strictly Lagrangian or Eulerian kinematics, was achieved by introducing an auxiliary kinematic velocity field along the free surface in order to vary the trajectories used in integrating the ordinary differential equations simulating the moving boundary. The computation of the velocity potential was based upon a nonuniform triangular mesh which was automatically revised to varying depths to accommodate the motion of the free surface. These methods permitted calculation of draining induced axisymmetric slosh through the many (or fractional) finite amplitude oscillations that can occur depending upon the balance of draining, gravitational, and surface tension forces. Velocity fields, evolution of the free surface with time, and liquid residual volumes were computed for three and one half decades of Weber number and for two Bond numbers, tank fill levels, and drain radii. Comparisons with experimental data are very satisfactory. Author

N76-26424*# Transemantics, Inc., Washington, D.C.
WAVE PROCESSES IN TWO-PHASE SYSTEMS
S. S. Kutateladze, ed. NASA Mar. 1976 249 p refs Transl. into ENGLISH of the book "Volnovyye Protsessy v Dvykhfaznykh Sistemakh" Novosibirsk, Acad. Sci. USSR, Siber. Dept., Inst. of Thermophysics, 1975 p 1-270
(Contract NASw-2792)
(NASA-TT-F-16803) Avail: NTIS HC $8.00 CSCL 20D

The data and methods for calculating the propagation of finite amplitude perturbations and shock waves in the two-phase media of the gas and vapor bubble-filled liquid are presented. The results and methods are given of the experimental study of these waves and their comparison with a supposed calculation

method being based on the approximation of Burgers-Corteveg-de Friz in models of the media covered. Author

N76-26425*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
AN EXPERIMENTAL INVESTIGATION OF AN AXISYMMETRIC JET IN A COFLOWING AIRSTREAM
G. D. Catalano, J. B. Morton, and R. R. Humphris 11 May 1976 37 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Sep. 1976
(Grants NGR-47-005-219; NSF GK-40126)
(NASA-CR-143104; ESS-4043-106-75-Rev) Avail: NTIS HC $4.00 CSCL 20D

The flow development of an axisymmetric jet exhausting into a moving airstream has been studied. The jet has a Reynolds number of 22,600, and the ratio of the jet velocity to the wind tunnel velocity is 5.1 to 1. The flow field of the axisymmetric jet was examined at locations varying from approximately zero to eight diameters downstream of the orifice. Of primary concern at each downstream location was the mapping of the one point statistical properties of the flow, including mean velocity, turbulent intensity, and intermittency. Autocorrelations and power spectral density curves were determined for both the fluctuating velocity field and the concentration signal at various distances from the jet's center line for different downstream locations. A laser Doppler velocimeter, using a phase locked loop processor, was used to make the desired velocity field measurements which were compared with hot wire anemometer and pressure probe data. Author

N76-26426# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF TRANSONIC NONSTATIONARY FLOW IN THE PRESENCE OF PHASE TRANSFORMATIONS
G. A. Saltanov and R. A. Tkalenko [1975] 8 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 6, 1975 p 42-48
Avail: NTIS HC $3.50; National Translations Center, John Crerar Library, Chicago, Illinois 60616

Condensation of supersaturated vapor in a transonic stream may result in nonstationarity of the flow. This is due to extraction of the latent heat of condensation, the formation of a shock and its interaction with the condensation zone. Significant pulsations of the stream parameters (with 500 to 1,000 Hz frequency), originating during the flow of moist air and pure water vapor in air, were measured. An approximate similarity law is derived for the dimensionless nonstationary flow frequency. The phenomenon under consideration was studied by the method of inversion of the effect, while theoretical computations were made and a diagram permitting determination of the limits of the flow stability domain was confirmed experimentally. It is found that the frequency of pressure and density fluctuation can reach 6,000 Hz in a flow with moist air condensation. A numerical solution of the system of equations describing nonstationary quasi-one-dimensional flow with spontaneous condensation in the transonic part of a Laval nozzle is obtained. Author

N76-26427# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE MECHANISM OF THE BOILING PROCESS ON SUBMERGED SURFACES WITH CAPILLARY-POROUS COVERING
O. N. Mankovskii, O. B. Ioffe, L. G. Fridgant, and A. R. Tolchinskii [1976] 7 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (USSR), v. 30, no. 2, 1976 p 310-316
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A simplified mathematical model is constructed which relies on physical representations of the most essential aspects of the process. An analysis of results of investigations on boiling in porous coatings yields the following information about the mechanism of the process. A vapor is formed during heating of the fluid within the porous layer, and is eliminated through certain pores while new portions of fluid are sucked in through other pores because of capillary forces. The question arises as to namely what affords the possibility of obtaining high heat fluxes as well as the process of developed nucleate boiling at such low Delta T (sometimes a fraction of a degree) while boiling on surfaces without a porous coating requires much greater heat for the formation and growth of vapor bubble nuclei. This fact can be explained by assuming that there are cavities with phase separation boundaries within the porous layer. Author

N76-26428# Lockheed Missiles and Space Co., Palo Alto, Calif.
SOLUTION OF THE DIRECT PROBLEM OF THE FLOW OF A TWO-PHASE MIXTURE OF A GAS AND FOREIGN SOLID OR LIQUID PARTICLES IN A LAVAL NOZZLE
V. I. Kopchenov [1975] 7 p refs Transl. into ENGLISH from Prikl. Mekhan. i Tekhn. Fiz. (USSR), no. 6, 1975 p 37-42
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The flow of a mixture of gas and foreign particles in the sub-, trans-, and supersonic parts of a Laval nozzle is examined within the framework of a two-fluid (two-velocity and two-temperature) model of a continuous medium. In the case of a thin near-wall layer of pure gas, the problem is solved in two stages. Initially a stream core is computed by the build-up method, where the gas flows with particles, the parameters in the pure gas layer are hence determined approximately and then the parameter distribution is found by simplified equations (of the boundary-layer equation type) in the pure gas zone, and the flow in the stream core is refined. Examples of the computation are presented. Use of the method developed permitted establishment of some singularities of the flow of a gas mixture with particles in a Laval nozzle in the case of a Stokes law of flow around the foreign particles. Author

N76-26429*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SOLUTION OF A LARGE HYDRODYNAMIC PROBLEM USING THE STAR-100 COMPUTER
K. James Weilmuenster and Lona M. Howser May 1976 30 p refs
(NASA-TM-X-73904) Avail: NTIS HC $4.00 CSCL 20D

A representative hydrodynamics problem, the shock initiated flow over a flat plate, was used for exploring data organizations and program structures needed to exploit the STAR-100 vector processing computer. A brief description of the problem is followed by a discussion of how each portion of the computational process was vectorized. Finally, timings of different portions of the program are compared with equivalent operations on serial machines. The speed up of the STAR-100 over the CDC 6600 program is shown to increase as the problem size increases. All computations were carried out on a CDC 6600 and a CDC STAR 100, with code written in FORTRAN for the 6600 and in STAR FORTRAN for the STAR 100. Author

N76-26430*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMMENTS ON THE ROLE OF DIAGONAL DOMINANCE IN IMPLICIT DIFFERENCE METHODS
David H. Rudy and Richard S. Hirsh May 1976 18 p refs
(NASA-TM-X-73905) Avail: NTIS HC $3.50 CSCL 20D

Numerical tests were made for a model of the Navier-Stokes equations using a second-order accurate implicit scheme which guarantees diagonal dominance. The results suggest that the failure of implicit methods using large marching steps may not always be attributed to the lack of diagonal dominance in the coefficient matrix. In some cases the failure may be caused by a nonlinear instability associated with the solution method. Author

N76-26431*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMODYNAMIC, TRANSPORT, AND FLOW PROPERTIES OF GASEOUS PRODUCTS RESULTING FROM COMBUSTION OF METHANE-AIR-OXYGEN
George F. Klich Washington Jun. 1976 102 p refs
(NASA-TN-D-8153; L-10627) Avail: NTIS HC $5.50 CSCL 20D

Results of calculations to determine thermodynamic, transport, and flow properties of combustion product gases are presented. The product gases are those resulting from combustion of methane-air-oxygen and methane-oxygen mixtures. The oxygen content of products resulting from the combustion of methane-air-oxygen mixtures was similiar to that of air; however, the oxygen contained in products of methane-oxygen combustion ranged from 20 percent by volume to zero for stoichiometric combustion.

Calculations were made for products of reactant mixtures with fuel percentages, by mass, of 7.5 to 20. Results are presented for specific mixtures for a range of pressures varying from 0.0001 to 1,000 atm and for temperatures ranging from 200 to 3,800 K. Author

N76-26432*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF A SURFACE-TO-GAP TEMPERATURE DISCONTINUITY ON THE HEAT TRANSFER TO REUSABLE SURFACE INSULATION TILE GAPS
David A. Throckmorton Washington Jun. 1976 35 p refs (NASA-TN-D-8233; L-10766) Avail: NTIS HC $4.00 CSCL 20D

An experimental investigation is presented that was performed to determine the effect of a surface-to-gap wall temperature discontinuity on the heat transfer within space shuttle, reusable surface insulation, tile gaps submerged in a thick turbulent boundary layer. Heat-transfer measurements were obtained on a flat-plate, single-gap model submerged in a turbulent tunnel wall boundary layer at a nominal free-stream Mach number of 10.3 and free-stream Reynolds numbers per meter of 1.5 million, 3.3 million and 7.8 million. Surface-to-gap wall temperature discontinuities of varying degree were created by heating the surface of the model upstream of the instrumented gap. The sweep angle of the gap was varied between 0 deg and 60 deg; gap width and depth were held constant. A surface-to-gap wall temperature discontinuity (surface temperature greater than gap wall temperature) results in increased heat transfer to the near-surface portion of the gap, as compared with the heat transfer under isothermal conditions, while decreasing the heat transfer to the deeper portions of the gap. The nondimensionalized heat transfer to the near-surface portion of the gap is shown to decrease with increasing Reynolds number; in the deeper portion of the gap, the heat transfer increases with Reynolds number. Author

N76-26433# Karlsruhe Univ. (West Germany). Inst. fuer Stroemungslehre und Stroemungsmaschinen.
NONEQUILIBRIUM FLOW OF GASES AT HIGH TEMPERATURES, INVESTIGATED FOR SHOCK WAVES IN ARGON AND NITROGEN [NICHTGLEICHGEWICHTSSTROEMUNG VON GASEN BEI HOHEN TEMPERATUREN, UNTERSUCHT AN VERDICHTUNGSSTOESSEN IN ARGON UND STICKSTOFF]
B. Schmidt and H. Alsmeyer Bonn DOKZENTBw 1975 52 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung
(BMVg-FBWT-75-14) Avail: NTIS HC $4.50; DOKZENTBw DM 30

The nonequilibrium flow in shock waves was investigated to proove the usefulness of different approaches to flow analysis such as methods based on continuum concepts or on numerical simulation of an artificial gas composed of a limited number of molecules. Density profiles of shock waves in argon and nitrogen have been measured with a high degree of accuracy. The comparison of the experimental results with the theoretical ones, based on continuum concepts (Navier-Stokes approximation) shows differences that already become visible at small deviations from equilibrium. The numerical simulation gives an excellent agreement with the experimental results even for large deviations from equilibrium. Using the numerical simulation method the constants of the intermolecular potential for argon and nitrogen and the rotational relaxation number for N2 can be determined by a fitting procedure. Knowing these constants permits calculation of the shear viscosity and the bulk viscosity. The present experiments make possible calculation of the viscosity up to 6,000 K. Author (ESA)

N76-26434# Bari Univ. (Italy). Ist. di Macchine.
CHARACTERISTICS OF HELICAL AND STRAIGHT LOBE COMPRESSORS [SULLA CARATTERISTICA DEI COMPRESSORI A LOBI ELICOIDALI E DIRITTI]
Andrea Dadone, M. Napolitano, and G. Vacca Jun. 1974 21 p refs In ITALIAN
Avail: NTIS HC $3.50

Experimental tests were performed on a compressor with helicoidal lobes and the results compared with two theoretical models taken from the literature together with a new one which is proposed. These models were also compared with respect to Roots compressors. The new proposed model and one of the previously reported models are shown to yield acceptable forecasts of the machine behavior provided a few preliminary experimental tests can be performed beforehand. ESA

N76-26435# European Space Agency, Paris (France).
INFLUENCE OF NOZZLE GEOMETRY ON VIBRATIONAL RELAXATION IN AN EXPANSION FLOW
Carl Dankert Feb. 1976 70 p refs Transl. into ENGLISH of 'Einfluss der Duesengeometrie auf das Relaxationsverhalten einer hypersonischen Expansionsstroemung', DFVLR, Goettingen, West Ger. Report DLR-FB-75-17, 6 Jan. 1975 Original German report available from DFVLR, Porz, West Ger. DM 35.80
(ESA-TT-255; DLR-FB-75-17) Avail: NTIS HC $4.50

An experimental study is presented of a hypersonic flow in which the rapidity of the expansion process was changed using various nozzles with different subsonic geometries but the same supersonic design. The measured vibrational temperature shows a dependence on the nozzle geometry. Comparison with calculations indicates identical magnitude of the relaxation time in expansion flows and shock waves. Author (ESA)

N76-26436# RAND Corp., Santa Monica, Calif.
CONTROLLING THE SEPARATION OF LAMINAR BOUNDARY LAYERS IN WATER: HEATING AND SUCTION
J. Aroesty and S. A. Berger Sep. 1975 38 p refs
(Contract DAHC15-73-C-0181; ARPA Order 189-1)
(AD-A020026; R-1789-ARPA) Avail: NTIS CSCL 20/4

The effects of suction on the delay of separation are well known--analyses, computations, and measurements over the past seventy years have shown that laminar separation can be delayed almost indefinitely, if the additional complexities and costs of suction are tolerable. However, the effects of surface heating on delay of separation are less well known--there are no measurements available, and there are no directly applicable analyses or computations. To fill this gap, an analysis of the minimum surface overheat that will delay separation for a prescribed adverse pressure gradient in water is given. GRA

N76-26437# Naval Research Lab., Washington, D.C.
THE EFFECTS OF VORTEX COHERENCE, SPACING, AND CIRCULATION ON THE FLOW-INDUCED FORCES ON VIBRATING CABLES AND BLUFF STRUCTURES Interim Report
S. Ramberg and O. M. Griffin 2 Jan. 1976 36 p refs
(NRL Proj. F02-36; YF53535004)
(AD-A019196; NRL-7945) Avail: NTIS CSCL 20/4

The vortex wake of a vibrating flexible cable was studied by means of velocity measurements and correlation, frequency spectra, and flow visualization. Three distinct spanwise regimes were identified according to wake structure. Near the cable nodes the flow resembles that of a stationary cable. Adjacent to the node is a transition regime which extends up to the locked-in or synchronized wake flow about the cable antinode. Each regime was characterized by spectral content, degree of spanwise correlation, and local vortex street geometry. Measured downstream velocity profiles and vortex spacing were matched with a mathematical model to obtain the vortex strength and its relation to cable vibration conditions. The Von Karman drag formula was used to compute the steady drag coefficients directly, and the distributions of fluctuating lift and drag were inferred from the data. The vortex strength and fluid forces on the vibrating cable were found to be as much as 65 percent larger for locked-in conditions than in the stationary case. Where comparisons were possible, there was good agreement between present results and previous results for vortex-excited rigid cylinders, including some direct measurements of the increased drag. Author (GRA)

N76-26438# Naval Ship Research and Development Center, Bethesda, Md. Aviation and Surface Effects Dept.
EXPERIMENTAL INVESTIGATION OF THE HIGH VELOCITY COANDA WALL JET APPLIED TO BLUFF TRAILING EDGE CIRCULATION CONTROL AIRFOILS Research and Development Report, Sep. 1971 - Apr. 1973
Robert J. Englar Sep. 1975 117 p refs Supersedes TN-AL-308
(AD-A019417; Aero-1213; TN-AL-308) Avail: NTIS CSCL 20/4

A two-dimensional experimental investigation, intended to probe the mechanism for reduction in performance of circulation control elliptic airfoils in compressible flow, was conducted subsonically on a 20-percent-thick modified elliptic profile employing high Coanda wall jet velocities. The results include detailed pressure distributions (both normal and chordwise) and trailing edge shear stress measurements made with a hot film anemometer for a range of jet slot heights and jet total pressures corresponding to high subsonic, sonic, and supersonic jet velocities. Jet Mach numbers of almost 1.3 were found to have no adverse effects on the airfoil performance, and the degrading jet detachment phenomenon was never encountered. Significant differences in the jet flow field with and without an external free stream were noted, as was the deviation of the static pressure across the jet from a constant value as assumed in conventional boundary layer analysis. Airfoil lift performance was found to vary with slot height, and the detailed shear stress measurement enabled location of the jet separation point. Also discussed is the calibration and use of the hot film shear stress probe. Author (GRA)

N76-26439# Johns Hopkins Univ., Baltimore, Md. Dept. of Mechanics and Materials Science.
STRUCTURE OF THE TURBULENCE IN THE PLANE WAKE BEHIND A HEATED FLAT PLATE
Syed Firasat Ali and Leslie S. G. Kovasznay Aug. 1975 147 p refs
(Contract F44620-74-C-0024; AF Proj. 9781)
(AD-A019559; AFOSR-75-1657TR) Avail: NTIS CSCL 20/4

A slightly heated plane turbulence wake was obtained behind a flat plate in incompressible air flow. Hot-wire measurements were carried out to obtain the conventional averaged quantities, the intermittency properties and the conditional turbulent and non-turbulent zone averages of velocity and temperature and their fluctuations. On the basis of the measurements obtained, the question of self-preservation was examined and a limited self-preservation was found with some qualifications. In order to verify the approach of the flat-plate-wake to a universal plane turbulent wake structure, the results were compared with the existing data for the wake of a circular cylinder. The large scale turbulence structure and its role in momentum and heat transfer were studied by measuring two point space time correlations involving temperature, and streamwise and normal velocity fluctuations. Author (GRA)

N76-26440# DCW Industries, Sherman Oaks, Calif.
FURTHER REFINEMENT OF THE TURBULENCE-MODEL TRANSITION-PREDICTION TECHNIQUE
D. C. Wilcox and T. L. Chambers Jul. 1975 85 p refs Presented at the 8th Fluid and Plasma Dynamics Conf., Hartford, 16-18 Jun. 1975
(Contract F44620-74-C-0048; AF Proj. 9781)
(AD-A019552; DCW-R-03-02; AFOSR-75-1682TR) Avail: NTIS CSCL 20/4

Various aspects of a turbulence-model-transition-prediction method have been analyzed. The primary aims of the research have been to develop an understanding of the relation of model-predicted transition to the important physical processes and to improve, generalize, and further validate the model. Progress has been made in developing understanding of (1) low-Reynolds-number modifications to the turbulence generation terms and (2) the method used to simulate surface roughness effects on transition. As a result of this improved understanding, boundary conditions for the model have been revised and the model now predicts a roughness-dominated transition regime. To further validate the model, effects of pressure gradient on flat-plate boundary-layer transition have been analyzed. Generalization of boundary conditions for flows with mass injection has also been accomplished. The model has been generalized to include effects of coordinate-system rotation; the improved model accurately predicts laminarization in rotating channel flow. Author (GRA)

N76-26441# Wisconsin Univ., Madison. Mathematics Research Center.
ON VISCOUS FLUID FLOW DOWN AN INCLINED PLANE AND THE DEVELOPMENT OF ROLL WAVES Technical Summary Report
Alfred Carasso and Mei-Chang Shen Oct. 1975 52 p refs
(Contract DAAG29-75-C-0024; Grant NSF MPS-75-06366)
(AD-A020203; MRC-TSR-1565) Avail: NTIS CSCL 20/4

The authors develop a tractable, and mathematically rigorous, asymptotic theory for the development of instability in viscous fluid flow down an inclined plane, at supercritical Reynolds numbers. The theory involves consideration of an ill posed problem, and provides a new example of the way such problems come up in applied mathematics. It is shown how one may use additional information, inherent in the problem one really wishes to solve, in order to regularize this improperly posed problem. The authors discuss several numerical experiments and compare the results with experimental observations of 'roll waves' and 'slug flows' in inclined channels, at similar slopes and Reynolds numbers. The results are in agreement with observations. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N76-26442 Illinois Inst. of Tech., Chicago.
OPTICAL TECHNIQUES TO SEPARATE COMPONENTS OF DISPLACEMENT USING HOLOGRAPHIC INTERFEROMETRY Ph.D. Thesis
John Andrew Gilbert 1975 168 p
Avail: Univ. Microfilms Order No. 76-13144

An introduction to holography and holographic interferometry is given with enough background information to justify their application to experimental mechanics problems. Single and multiple hologram analyses are introduced in conjunction with the experimental determination of a complicated three-dimensional displacement field. To eliminate data reduction, the spatial frequency content of the virtual image, produced from a multiply-exposed hologram, is controlled by placing restrictions on the physical parameters of the holographic set-up. Each fringe pattern represents a single component of displacement. Certain limitations are imposed on the method by governing assumptions; however, this approach demonstrates that an optical superposition of multiple holograms can replace numerical computation. To eliminate these restrictions, a symmetrical double beam illumination is used in conjunction with a fictitious fringe system to obtain a moire' pattern which represents the projection of the displacement into a single plane. Dissert. Abstr.

N76-26443*# Scientific Translation Service, Santa Barbara, Calif.
OPTICAL VIBRATION SENSOR
Michel Philbert and Jean Surget Washington NASA Jun. 1976 31 p refs Transl. into ENGLISH from Mesures-Regulation-Automatisme (France), no. 1-2, Jan. - Feb. 1975 p 45-54
(Contract NASw-2791)
(NASA-TT-F-15482) Avail: NTIS HC $4.50 CSCL 20F

An electrooptic setup is described that operates in incoherent light with a simple geometric-optical arrangement and is capable of measuring the displacements of a vibrating structure without making contact with the structure. An adhesive patch with catadioptic properties is placed on selected points of the structure tested. The measuring unit illuminates the area around the patch and senses the backscattered light, forming the image of the patch on a knife. A light-sensitive sensor behind the knife records the variations of returning luminous flux caused by displacements of the image. An electric signal is produced at the frequency of vibration and with amplitude depending on the distance to the given point on the structure. The three components of the vibration vector at any point can be obtained, from which the modulus, phase, and orientation can then be derived. Author

N76-26444*# California Univ., La Jolla. Dept. of Applied Physics and Information Science.
THE APPLICATION OF AN OPTICAL FOURIER SPECTRUM ANALYZER ON DETECTING DEFECTS IN MASS-

PRODUCED SATELLITE PHOTOGRAPHS Final Report
Ravi Athale and Sing H. Lee 21 Jun. 1976 48 p refs
(Grant NGR-05-009-264)
(NASA-CR-148198) Avail: NTIS HC $4.00 CSCL 14E

Various defects in mass-produced pictures transmitted to earth from a satellite are investigated. It is found that the following defects are readily detectable via Fourier spectrum analysis: (1) bit slip, (2) breakup causing loss of image, and (3) disabled track at the top of the imagery. The scratches made on the film during mass production, which are difficult to detect by visual observation, also show themselves readily in Fourier spectrum analysis. A relation is established between the number of scratches, their width and depth and the intensity of their Fourier spectra. Other defects that are found to be equally suitable for Fourier spectrum analysis or visual (image analysis) detection are synchronous loss without blurring of image, and density variation in gray scale. However, the Fourier spectrum analysis is found to be unsuitable for detection of such defects as pin holes, annotation error, synchronous loss with blurring of images, and missing image in the beginning of the work order. The design of an automated, real time system, which will reject defective films, is treated. Author

N76-26445*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE PROBLEM OF EMBEDDING PICTURE ELEMENTS IN REGIONS
Y. Yakimovsky and R. Cunningham 1 Jun. 1976 35 p refs
(Contract NAS7-100)
(NASA-CR-148279; JPL-TM-33-774) Avail: NTIS HC $4.00 CSCL 14E

A few new algorithms for region growing in pictures were developed. These algorithms are a step toward finding a satisfactory solution to the image segmentation problem, and in-depth understanding of the problems of nonsemantic image segmentation. The algorithms utilize a sequential decision approach for region boundaries detection. The sequential decisions are supported by a stochastic algorithm that maintains local statistics of the region near the boundaries as the region grows. A few illustrations of the algorithm's performance are included. Author

N76-26446*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REAL TIME REFLECTOMETER Patent Application
James M. Zwiener, inventor (to NASA) Filed 28 May 1976 22 p
(NASA-Case-MFS-23118-1; US-Patent-Appl-SN-691256) Avail: NTIS HC $3.50 CSCL 20F

A real time reflectometer is described for measuring fairly rapid (transient) changes in the specular reflectance of a sample continuously exposed to a perturbing environment containing a fixed radiation source, a fixed detector, a uniformly rotating sample wheel, and a uniformly rotating optical wheel. The plane of rotation of the sample wheel and the optical wheel are normal to one another, and the gear drives of both wheels are interconnected and are driven by a single drive motor insuring the alignment of the mirrors contained on the optical wheel with the sample present on the sample wheel. The radiation source generates light directed toward the uniformly rotating sample wheel containing a test sample and an aperture. Light reflected off the test sample is also reflected from the optical wheel and directed toward the detector. The reflectance value of the reflected light is compared to that of a reference signal established by light passing through the aperture, reflected from the optical wheel and directed toward the detector. NASA

N76-26447*# National Aeronautics and Space Administration. Pasadena Office, Calif.
DIRECT READING INDUCTANCE METER Patent Application
Richard B. Kolbly, inventor (to NASA) (JPL) Filed 15 Apr. 1976 12 p Sponsored by NASA
(NASA-Case-NPO-13792-1; US-Patent-Appl-SN-677351) Avail: NTIS HC $3.50 CSCL 14B

A direct reading inductance meter is described. The meter is comprised of a crystal oscillator for generating a reference frequency f sub r and an LC tuned oscillator for generating an initial frequency f sub o which, when mixed with the reference, produces a difference equal to zero. Upon connecting an inductor of small unknown value in the LC circuit to change its resonant frequency to f sub x, a difference frequency (f sub r - f sub x) is produced that is very nearly a linear function of the inductance of the inductor. The difference frequency is measured and displayed on a linear scale in units of inductance. NASA

N76-26448*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
A CONDITION SENSOR SYSTEM AND METHOD Patent Application
John T. Polhemus, Joseph E. Morgan, and Arthur Mandell, inventors (to NASA) Filed 21 May 1976 15 p
(Contract NAS9-14215)
(NASA-Case-MSC-14805-1; US-Patent-Appl-SN688856) Avail: NTIS HC $3.50 CSCL 06B

The condition sensor system described comprises a condition detector which produces a pulse when a parameter of the monitored condition exceeds a desired threshold. A resettable condition counter counts each pulse. A resettable timer is preset to produce a particular time frame. The counter produces a condition signal when the accumulated number of pulses within the time frame is equal to or greater than a preset count. Control means responsive to the incoming pulses and to the condition signal produce control signals that control utilization devices. After a suitable delay, the last detected pulse simultaneously resets the pulse counter and the timer, and prepares them for sensing another condition occurrence within the time frame. The invention has particular utility for detecting the rocking motions of blind people, and warning them with a controlled, audible, biofeedback signal. NASA

N76-26449*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF POST-PROCESS INTENSIFICATION OF IMAGES ON PHOTOGRAPHIC FILMS AND PLATES Patent Application
Barbara S. Askins, inventor (to NASA) Filed 9 Jun. 1976 28 p
(NASA-Case-MFS-23461-1; US-Patent-Appl-SN-694406) Avail: NTIS HC $3.50 CSCL 14E

A method of post-process intensification of silver images on developed photographic films and plates is described. The steps include: converting the silver of the developed film or plate to a radioactive compound by treatment with an aqueous alkaline solution of an organo-S35 compound; placing the treated film or plate in direct contact with a receiver film which is then exposed by radiation from the activated film; and developing and fixing the resulting intensified image on the receiver film. NASA

N76-26450*# National Aeronautics and Space Administration. Pasadena Office, Calif.
PHOTOELECTRON SPECTROMETER WITH MEANS FOR STABILIZING SAMPLE SURFACE POTENTIAL Patent Application
Frank J. Grunthaner (JPL) and Blair F. Lewis, inventors (to NASA) (JPL) Filed 9 Apr. 1976 24 p
(Contract NAS7-100)
(NASA-Case-NPO-13772-1; US-Patent-Appl-SN-676351) Avail: NTIS HC $3.50 CSCL 14B

An improved X-ray photoelectron spectrometer is described, which includes circuits for determining the surface potential of an insulator. The circuits comprise an electron gun, whose potential is modulated at a preselected frequency above and below a selected potential with respect to the spectrometer common potential, e.g., ground. The beam of electrons is directed to the sample surface. The sample's surface potential is offset by an offset power supply with respect to the spectrometer common potential until the ac current which flows through the sample reaches a peak amplitude. A lock-in amplifier is included to measure the ac current in phase with the modulating frequency. NASA

N76-26451# National Aerospace Lab., Tokyo (Japan).
STUDY OF A ROTARY DRIVE VIBRATORY OUTPUT TWO-DEGREE-OF-FREEDOM GYRO
Hiroshi Yamada Nov. 1975 20 p refs

(NAL-TR-290T) Avail: NTIS HC $3.50

A rotary-drive vibratory-output two-degree-of-freedom gyro to be used as an attitude control device to provide the inertial reference for flight vehicles such as rockets was studied. The unconventional gyro is constructed with an asymmetrical rotor mounted in two prependicular gimbals. The moments of inertia of the rotor about its three principal axes are unequal. If the rotor is rotating around one of its principal axes at a constant angular rate and the gyro is experiencing an angular rate which has a component in the plane of the rotor rotation, a vibratory torque at twice the spin frequency of the rotor is induced about two gimbal axes normal to the rotor spin axis. A prototype of this gyro was made and tested. The experimental results are presented and are in good agreement with the theoretical description; they show that the rate resolution is of the order 0.001 deg/sec based on a unity signal-to-noise ratio. Author

N76-26452*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AN ANALOG TECHNIQUE FOR THE MEASUREMENT OF DAMPING FROM TRANSIENT DECAY SIGNALS

William G. Bousman (Army Air Mobility R and D Lab., Moffett Field, Calif.) Jun. 1976 19 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.

(NASA-TM-X-73121; A-6535) Avail: NTIS HC $3.50 CSCL 09C

A tracking filter that includes an output that is logarithmically proportional to the amplitude of the filtered signal is used to measure the damping exponent of a transient decay. This method is analogous to the digital technique referred to as the moving-block or peak-plot method. The method is simple to use and quite accurate, avoids the numerical computations associated with similar digital techniques, but is constrained by the poor time-domain response characteristics of commercial tracking filters presently available. Author

N76-26453# California Univ., Livermore. Lawrence Livermore Lab.

CHARGED-PARTICLE MAGNETIC-QUADRUPOLE SPECTROMETER FOR NEUTRON INDUCED REACTIONS

R. C. Haight and S. M. Grimes 10 Dec. 1975 28 p refs Presented at the APS Meeting, Austin, Tex. 30 Oct. 1975

(Contract W-7405-eng-48)

(UCRL-77151; Conf-751088-1) Avail: NTIS HC $4.00

A spectrometer developed for measuring the charged particle production cross sections and spectra in neutron-induced reactions is described. The spectrometer consists of a magnetic quadrupole doublet which focuses the charged particles onto a silicon surface barrier detector telescope which is 2 meters or more from the irradiated sample. Collimators, shielding, and the large source-to-detector distance reduce the background enough to use the spectrometer with a 14-MeV neutron source producing 4 x 10 to the 12th power n/s. The spectrometer was used in investigations of proton, deuteron, and alpha particle production by 14-MeV neutrons incident on various materials. Protons with energies as low as 1.1 MeV were measured. The good resolution of the detectors made possible an improved measurement of the neutron-neutron scattering length from the 0 deg proton spectrum from deuteron breakup by 14-MeV neutrons.

Author (NSA)

N76-26454# Commissariat a l'Energie Atomique, Saclay (France).

HIGH RESOLUTION MAGNETIC SPECTROMETRY

R. Beurtey 1975 72 p refs Presented at the Proc. of the Advanced Study Inst. in Nuclear and Particle Phys. at Intermediate Energies, Victoria, B. C., Canada, Jun. 1975

(Cea-Conf-3152; Conf-7506100-2) Avail: ERDA Depository Libraries HC $4.50

The high-resolution magnetic spectrometers SPES I and SPES II at Saturne are described in detail. The principles necessary to achieve a high resolution with magnetic spectrometers are described, and the future of high resolution spectrometry at Saturne is discussed. NSA

N76-26455# AEG-Telefunken, Ulm (West Germany).

DEVELOPMENT OF FILMS FOR PHASE HOLOGRAMS USED IN OPTICAL WAVEGUIDE COUPLING Final Report [ENTWICKLUNG VON SCHICHTEN FUER PHASENHOLOGRAMME ZUR LICHTWELLENLEITERKOPPLUNG]

Gabor Paal Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 30 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.

(BMFT-FB-T-75-27) Avail: NTIS HC $4.00; ZLDI, Munich DM 6,30

A material was produced for recording holograms, without holographic necessitating wet development. This material is to be used in waveguide coupling. Experiments have shown that crosslinking of appropriate polymers is possible in the spectral range of 700 to 870 nm, causing a change in the optical properties of films made of these polymers. Afterwards the still light sensitive materials can be desensitized and made transparent without wet developing and fixation. A phase grating produced by HeNe laser irradiation is preserved also after desensitization of the film and destroying of the dye. Author (ESA)

N76-26456# Arthur Pfeiffer Vakuumtechnik G.m.b.H., Wetzlar (West Germany).

FURTHER DEVELOPMENT OF TURBOMOLECULAR PUMPS Final Report [WEITERENTWICKLUNG VON TURBOMOLEKULARPUMPEN]

Willi Becker and Wilfried Nesseldreher Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 97 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.

(BMFT-FB-T-75-33) Avail: NTIS HC $5.00; ZLDI, Munich DM 20,40

A new type of disk which permits a most favorable sizing of the pumps was developed for turbomolecular pumps. The specific suction speed (suction speed related to the active disk surface) of the high vacuum disk was improved from 1.15 1/s sq cm to 5 1/s sq cm, and the compression ratio of the initial vacuum disks could be improved from 1 : 3.3 to 1 : 30. The possibility of remarkably higher rotation speeds caused problems with regard to bearings, cooling and drive. The solution of these problems is described. Construction of the new pumps and results are explained. Author (ESA)

N76-26457# Impulsphysik G.m.b.H., Hamburg (West Germany).

RAMAN LIDAR SPECTROSCOPY WITH IMAGE INTENSIFIER PLATES (MCP). PRELIMINARY STUDY Final Report [RAMAN-LIDAR-SPEKTROSKOPIE MIT BILDVERSTAERKERPLATTE (MCP), VORSTUDIE]

Gerhard Kuper, Frank Fruengel, and Dietrich Ebeling Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 36 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.

(BMFT-FB-T-75-34) Avail: NTIS HC $4.00; ZLDI, Munich DM 7,60

The main advantage of the Raman lidar method, the simultaneous measurement of all gas spectra, in air pollution monitoring has been realized by using multichannel plates. The development of a high energy laser (500 MW, 1 Hz) is discussed and the testing of improved frequency doublers based on potassium dihydrogen phosphates is dealt with. The reliability required for the measurements was achieved by means of a newly developed volume absorber calorimeter. ESA

N76-26458# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.

A SURFACE TOTAL HEAD/STATIC TUBE FOR SKIN FRICTION MEASUREMENT Final Report

A. Bertelrud Feb. 1976 31 p refs

(Contracts F-INK-82223-73-009-07-001; F-INK-82223-74-001-07-001; F-INK-82223-75-007-07-0)

(FFA-TN-AU-1133) Avail: NTIS HC $4.00

The necessity of measuring a true static pressure at the location of the tip of a Preston tube makes the method unsuitable in several cases of practical interest where the static pressure is difficult to obtain. A new alternative is described, combining total head/static tube where both pressures are measured on the same tube, thus eliminating the need of extra information. Assumptions and calibrations are presented, as well as estimates of pressure gradient effects. The yaw characteristics are also discussed. It is found that the calibration curve is similar to that of a Preston tube, and the yaw sensitivity is also of equal order. Author (ESA)

N76-26459# European Space Research and Technology Center, Noordwijk (Netherlands).
CALCULATION OF BASIC PERFORMANCE OF IMAGE-DISSECTOR-TUBE STAR TRACKERS
H. H. Sammuelsson Paris ESA Jan. 1976 21 p refs
(ESA-TM-165-ESTEC) Avail: NTIS HC $3.50

A procedure is defined for calculating those star tracker performance figures that depend on the fundamental signal-to-noise ratio of the detection system. It concerns star trackers using an image-dissector tube as the detector. Expressions are derived for signal, background, dark current, and noise for normal analog detector operation and for single photoelectron counting operation. Two sets of performance figures were calculated. For the acquisition mode, these are the single-look probability of detection and of false detection. For the tracking mode, they are expressions for the noise-equivalent angle based on two alternative assumptions concerning the energy distribution in the star image and on two different energy-balancing techniques for the derivation of the error signal. Author (ESA)

N76-26460# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
INTERCOMPARISON PROCEDURES FOR GAGE BLOCKS USING ELECTROMECHANICAL COMPARATORS Final Report
J. S. Beers and C. D. Tucker Jan. 1976 23 p refs
(PB-248992/0; NBSIR-76-976) Avail: NTIS HC $3.50 CSCL 14B

The widely used procedures for calibrating gage blocks by comparison with blocks of known length generally lack the redundancy needed to evaluate measurement uncertainty or the controls needed to monitor the process on a continuing basis. A detailed description is given for the systematized intercomparison of groups of four nominally equal gage blocks using an electromechanical comparator. Two of the blocks are unknowns and two are standards. The process provides the redundancy needed for evaluating uncertainty and for continuous monitoring. Gage block thermal effects, equalization time, handling techniques, and observation sequence are described. GRA

N76-26461# Naval Research Lab., Washington, D.C.
CRACK-LENGTH DETERMINATION FOR THE COMPACT TENSION SPECIMEN USING A CRACK-OPENING-DISPLACEMENT CALIBRATION-COMPARISON OF COD MEASURED GRAPHICALLY AND FROM THE GAGE OUTPUT Final Report
A. M. Sullivan 10 Dec. 1975 19 p refs
(NRL Proj. M01-24; RR0220146)
(AD-A019195; NRL-7941) Avail: NTIS CSCL 20/11

To implement the increasing trend toward automated testing procedures, crack-length measurement during fatigue crack-growth-rate testing was determined using a COD gage technique. Data were analyzed both graphically and using the gage output measured in millivolts. To compensate for nonlinearity in the load-vs-COD traces, it was found necessary to sample differences in the load millivolt readings to produce smooth da/dN-vs-deltaK curves agreeing with those determined from graphical analysis of crack length. Author (GRA)

N76-26462# Science Applications, Inc., La Jolla, Calif.
A PORTABLE GAS-FILTER-CORRELATION SPECTROMETER FOR HCl AND HF Final Report, 15 Jan. 1974 - 31 Jan. 1975
E. Roy Bartle Oct. 1975 42 p refs
(Contract F41609-74-C-0014; AF Proj. 7164)
(AD-A020032; SAI-75-525-LJ; SAM-TR-75-33) Avail: NTIS CSCL 14/2

A portable gas-filter-correlation spectrometer (GFCS) has been developed to continuously monitor HCl and HF over the concentration range from 0.2 to 1000 ppm. The unit operates using either 115 VAC 60 Hz or 12 VDC. The attained threshold sensitivities of 167 and 200 ppb for HCl and HF, respectively, are nearly those predicted from theoretical considerations. Excellent specificity is obtained in the presence of anticipated interfering species. The system also can be converted into an active long-path system using a retroreflector; ranges up to 500 m (1-km optical path) can be used with about the same sensitivities. A technique for passive single-ended remote sensing is described that appears to offer significant potential for ranges up to 1 km. This monitor can be used on air pollution detection. GRA

N76-26463# RAND Corp., Santa Monica, Calif.
REMOTE IMAGERY SUPPORT FOR INTERNATIONAL ORGANIZATIONS
William R. Harris Mar. 1975 10 p refs Presented at the Ann. Conv. of the Am. Soc. of Photogrammetry, Washington, D.C., 14 Mar. 1975
(AD-A019355; P-5401) Avail: NTIS CSCL 14/5

Remote imagery support for international organizations is discussed. Factors considered include: superiority of multilateral expliotation, fair pricing, declassification, and nondiscriminatory access. Emphasis is on protection of intelligence sources and methods. J.M.S.

N76-26464# Picatinny Arsenal, Dover, N.J.
MEASUREMENT OF ELECTRICAL IGNITION ELEMENT COMPOSITION MIX USING A GAMMA RAY DENSITOMETER
Louis G. Derrico and F. Madarasz Jan. 1976 50 p ref
(AD-A019273; PA-TR-4887) Avail: NTIS CSCL 14/2

Gamma ray measurements of electrical ignition elements containing ignition mixes with varying percentages of ingredients are presented. Correlations with visual observations of X-ray film, chemical analysis, and gamma ray counts are presented. Functional firing test results are also presented to demonstrate the relationship between accuracy of ignition mix, firing current requirements and ignition delay time. Various functional test techniques were explored in order to determine the method best suited for production testing. Author (GRA)

N76-26465# Naval Surface Weapons Center, White Oak, Md.
TWO-COMPONENT FORCE BALANCE FOR MEASURING SKIN FRICTION AND FRICTION AND SIDE FORCE
Eugene V. Horanoff and Richard T. Driftmyer Oct. 1975 20 p refs Presented at the Sixth Intern. Congr. Instrumentation in Aerospace Simulation Facilities, Ottawa, Canada, 22-24 Sep. 1975
(AD-A020025; NSWC/WOL/TR-75-174) Avail: NTIS CSCL 14/2

A two-component force balance was constructed which measured simultaneously the skin-friction force (drag force on a missile) and the orthogonal side force (roll-torque producing force). The test samples reported herein were designed to demonstrate the measurement technique. They were fabricated from aluminum. A successful test was performed in the NAVSURFWPNCEN Boundary Layer Channel using these aluminum test samples. GRA

N76-26466# Naval Postgraduate School, Monterey, Calif.
THERMOGRAPHIC IMAGING OF ELECTROMAGNETIC FIELDS M.S. Thesis. Final Report, Jan. - Dec. 1975
Claude A. LaVarre Dec. 1975 157 p refs Sponsored in part by Air Force Weapons Lab., Kirtland AFB, N. Mex.
(AD-A020079; NPS-52Zn75121) Avail: NTIS CSCL 14/5

It is recognized that a means of converting electromagnetic fields into visible images would greatly simplify the problem of designing structures to optimize their compatibility with such fields. Two needs must be met to allow such visualization. First, the fields must be transduced into a phenomenon which is capable of being imaged. Second, there must exist a sensor which senses that phenomenon and generates an image visible to the human eye. The bulk of this work was to investigate the parameters and limitations of one possible imaging procedure, called Dye Transfer Modulation (DTM). On the basis of that work and the development of a new sensor, the AGA Thermovision device was recognized as an exciting alternative to DTM. A brief investigation of its potential was conducted and is presented herein. GRA

N76-26467# Army Materiel Command, Alexandria, Va.
ENGINEERING DESIGN HANDBOOK, TIMING SYSTEMS AND COMPONENTS
Dec. 1975 490 p
(AD-A020020; AMCP-706-205) Avail: NTIS CSCL 14/2

The handbook presents both theoretical and practical data

pertaining to design methods and procedures for timing systems and devices. The subjects covered are precision reference timers, electronic timers, mechanical timers, pyrotechnic timers, flueric timers, and a few others. GRA

N76-26468# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DEVELOPMENT OF A 1.22-m-DIAM DYNAMIC AIR OVERPRESSURE SOIL TEST FACILITY Final Report
Stafford S. Cooper and Richard C. Sloan Jun. 1975 32 p refs
(AD-A013391; AEWES-Misc-Paper-S-75-20) Avail: NTIS CSCL 14/2

A large cold-gas-operated air overpressure test facility has been designed, fabricated, and installed at the U. S. Army Engineer waterways experiment station to test soil specimens 1.22 m in diameter and up to 5.03 m in length under static and blast-type loading conditions. A series of preliminary tests were conducted to evaluate the loading characteristics and overall performance of the facility and to compare results of uniaxial strain tests on dry sand with well documented and generally accepted results of tests on similar sand specimens conducted in a previously developed 12.70 cm diam uniaxial strain test device. Based on the results of these preliminary tests, the large air overpressure loader appears to function as required by the design specifications. Results of the tests conducted on dense sand specimens compared favorably with results of tests conducted on similar specimens in the 12.70 cm diam device. Results of tests conducted on loose sand did not agree as well as those from tests conducted on the dense sand. Author

N76-26469# Air Force Test and Evaluation Center, Kirtland AFB, N. Mex.
SEEKVAL PROJECT ID1, CHARACTERISTICS OF INHERENT AND APPARENT SCENES Final Report, Jul. 1974 - Sep. 1975
David R. Power Dec. 1975 271 p
(AD-A019935) Avail: NTIS CSCL 14/5

SEEKVAL Project ID1 was conducted to determine instrumentation and data reduction techniques suitable for measuring and documenting both apparent and inherent contrast during field tests. Three types of instrumentation were used: (1) cameras to photograph scenes from target acquisition ranges, (2) photometers to measure illumination of scene objects at close range, and (3) airborne and ground instruments for measuring atmospheric characteristics. Field data collection occurred at Ft. Lewis, Washington, during July 1974. It involved photographing and measuring illumination characteristics of a target scene consisting of trucks and portable Gray Scale panels. Simultaneously, characteristics of the atmosphere were measured by highly specialized equipment designed for the purpose. Eleven missions were flown covering both clear and overcast weather. Data reduction techniques, compatibility of instrumentation with field test aircraft and operations, costs, and adequacy of data are factors leading to recommendations for field test instrumentation. Guidance is given on use of photometers for vehicle type targets, the use of Gray Scale panels, targets, math models, color film, and infrared black and white film for determining target/background contrast. Author (GRA)

N76-26470# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
EXAMINATION OF VAPOR-MEASURING DEVICES FOR LIQUEFIED PETROLEUM GAS Final Report
Stephen Hasko Dec. 1975 28 p refs Supersedes NBS-HB-45
(PB-248987/0; NBS-HB-117; LC-75-619199; NBS-HB-45) Avail: NTIS HC $4.00 CSCL 14B

A manual is presented for State and local weights and measures officials for the examination and test of liquefied petroleum gas vapor measuring devices. Definitions, tests methods, and testing apparatus (including description and calibration procedures) are given. Inspection and test procedures are reviewed. A proposed test report form along with suggestions on reporting the results of a test are included. Provision is made for accommodating a changeover to metric units of registration in the definitions, correction tables, procedures, and in reporting a test. GRA

36 LASERS AND MASERS

Includes parametric amplifiers.

N76-26471 California Univ., Davis.
A NUMERICAL INVESTIGATION OF THE PULSED NF3+H2 CHEMICAL LASER USING A MODEL WHICH INCLUDES ROTATIONAL RELAXATION AND SEMI-CLASSICAL LASER EQUATIONS Ph.D. Thesis
John Rogers Creighton 1975 314 p
Avail: Univ. Microfilms Order No. 76-14199

Waveforms and population distributions were calculated by a numerical model and compared with experiment for an electric-discharge-initiated, pulsed NF3 + H2 chemical laser. The model treats each vibrational-rotational state separately, allowing rotational relaxation between adjacent states as well as vibrational relaxation and lasing according to P-branch selection rules. Simplified semi-classical laser equations, roughly equivalent to laser rate equations, are used; and waveforms for each P-branch transition are obtained. Simultaneous solution of a simplified set of chemical kinetic rate equations gives the pumping rate for each state. Calculated waveforms agree with experiment and show several features not seen when rotational equilibrium is assumed: simultaneous lasing on many transitions, cascade behavior, spikes due to laser relaxation oscillations, non-Boltzmann rotational distributions, and hole burning in the population distributions. Dissert. Abstr.

N76-26472 Florida Univ., Gainesville.
COMPUTER SIMULATION OF AN OPTICALLY PUMPED METHYL FLUORIDE LASER Ph.D. Thesis
Harvey Charles Schau, III 1975 117 p
Avail: Univ. Microfilms Order No. 76-12122

Employing a semi-classical model, numerical solutions were obtained for a ten-level model of methyl fluoride. Laser emission from methyl fluoride at approximately 16 microns was found to be possible by optically pumping with a carbon-dioxide laser. The methyl fluoride laser was found to have gain of approximately .51 percent per cm. and energy storage of approximately 31 (mJL to the -1 power)/torr. Dissert. Abstr.

N76-26473# Lockheed Missiles and Space Co., Palo Alto, Calif.
BELOW-THRESHOLD PHENOMENA IN LASER DAMAGE OF OPTICAL MATERIALS
Iu. K. Danileiko, A. A. Manenkov, and V. S. Nechitailo [1976] 6 p refs Transl. into ENGLISH from Kvantovaia. Elektron. (USSR), v. 3, no. 2, 1976 p 438-441
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The scattering of laser radiation was studied in sapphire crystals and in a number of glasses for intensities close to the threshold damage from one flare i sub d (both below and above it), determined by the formation of mechanical damage visible under a microscope on the laser apparatus. The method of nonlinear light scattering and crossed polaroids was used. The importance of the latter is that the scattered light is observed in minority polarization, which permits fixing the change in scattering in an intensity background significantly less than those recorded in observations of nonlinear light scattering of majority polarization which coincides with polarization of incident radiation. Author

N76-26474# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE SPATIAL COHERENCE OF LIGHT BEAMS IN FEEDBACK LASERS
A. S. Chirkin [1976] 4 p refs Transl. into ENGLISH from Kvantovaia Elektron. (USSR), v. 3., no. 2, 1976 p 352-356
Avail: NTIS HC $3.50: National Translation Center, John Crerar Library, Chicago, Illinois 60616

Interference effects in the laser cavity the gain effect play an important part in the formation of spatially coherent laser beams. Lasers with lumped and distributed feedback are considered. A connection between the natural angular broadening of the beams and the natural laser radiation line width is established. Theoretical estimates of angular broadening agree with experimental results for He-Ne lasers. Author

N76-26475# Lockheed Missiles and Space Co., Palo Alto, Calif.
OBTAINING GENERATION IN A CS2-O MIXTURE IN A SHOCK TUBE WITH SUPERSONIC NOZZLE
A. S. Bashkin, N. M. Gorsmunov, Iu. A. Kunin, Iu. P. Neshchimenko, A. N. Oraevskii, V. N. Tomashov, and N. N. Iuryshev [1976] 2 p refs Transl. into ENGLISH from Kvantovaia Slektron. (USSR), v. 3, no. 2, 1976 p 463-464
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Research is reported on the development of continuous chemical lasers using low toxicity reagents, specifically a carbon disulfide-oxygen mixture in a shock tube. The reactions responsible for the accrual of active carbon monoxide molecules during the oxidation of carbon disulfide were studied. Results of preliminary tests to obtain generation in carbon monoxide molecules formed as a result of the chemical reaction between carbon disulfide and oxygen in the shock tube are discussed. J.R.T.

N76-26476# Lockheed Missiles and Space Co., Palo Alto, Calif.
REFINEMENT OF THE REACTION RATE CONSTANTS IN A CF3I PHOTO-DISSOCIATION LASER
A. A. Filiukov, V. B. Mitrofanov, and T. V. Mishchenko [1976] 4 p refs Transl. into ENGLISH from Khim. Vys. Energ. (USSR), v. 10, no. 1, 1976 p 35-37
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Some reaction rate constants, essential for a CF3I photo-dissociation laser, are presented. New values of the rate constants of the same reactions are obtained, which are known to agree better with experimental results. The results are obtained by processing on an electronic computer and using modern multidimensional search methods. Author

N76-26477# Lockheed Missiles and Space Co., Palo Alto, Calif.
CERTAIN TENDENCIES IN LASER DEVELOPMENT
L. A. Shelepin [1975] 13 p refs Transl. into ENGLISH from Tr. Fiz. Inst., Akad. Nauk SSSR (USSR), no. 83, 1975 p 3-12
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

A number of the most prospective directions in the development of gas and plasma lasers are discussed. These lasers generate in a broad spectrum range from submillimeter to vacuum ultraviolet waves and are used extensively. An explosive rise in their output power has occurred in recent years. The problem of this paper, which introduces the collection, is twofold. The basic tendencies, lately manifested, showing the main difficulties and factors constraining the rise in laser power are traced. Author

N76-26478# Lockheed Missiles and Space Co., Palo Alto, Calif.
PHOTOINITIATED CO CHEMICAL LASER USING A CS2 + O2 MIXTURE
A. S. Bashkin, A. N. Oraevskii, V. N. Tomashov, and N. N. Iuryshev [1976] 9 p refs Transl. into ENGLISH from Kvant. Elektron. (USSR), v. 3, no. 2, 1976 p 362-368
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The possibility of using ozone as an oxidizer in a CO chemical laser, based on the oxidation of carbon disulfide was investigated. The high efficiency of the diluent SF6, as compared to He and Ar, is detected. An energy density of 4.5 mJ/cu cm was obtained, which is twice the value reached in a CS2 + O2 mixture under optimal conditions. Author

N76-26479# Lockheed Missiles and Space Co., Palo Alto, Calif.
AMPLITUDE AND FREQUENCY CHARACTERISTICS OF RING GAS LASERS
E. G. Pestov, V. P. Pokrovskii, and I. F. Usoltsev [1976] 9 p refs Transl. into ENGLISH from Kvant. Electron. (USSR), v. 3, no. 2, 1976 p 374-380
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Results of an experimental investigation of the amplitude and frequency characteristics of ring gas lasers are presented. The dependence of the additional shift in the beat frequency averaged with respect to the total phase of the coupling coefficients, as well as of the phase shift between the beat frequency and wave intensity variations due to the change in the total phase, on the cavity tuning is investigated for the first time. A complex investigation of the dependence of the beat frequency and the opposing wave intensity of ring gas lasers on the ring cavity tuning and the total phase of the coupling coefficients is carried out, which permits comparing different versions of ring gas laser theory. It is shown that far from the capture zone the dependence is due mainly to the difference between the cavity losses for the opposing waves. An increase in the beat frequency deviation is noted for a rise in the pumping intensity. The results of the experimental investigation are compared to theories of ring gas lasers. Author

N76-26480# Lockheed Missiles and Space Co., Palo Alto, Calif.
IODINE LASER WITH ACTIVE Q-SWITCHING
V. A. Katulin, V. Iu Nosach, and A. L. Petrov [1976] 8 p refs Transl. into ENGLISH from Kvantov. Elektron. (USSR), v. 3, no. 2, 1976 p 386-392
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The inversion storage, development time, spectrum composition, divergence, and shape of the light pulse of an iodine laser with active Q switching are investigated. An iodine laser with 8 mm beam diameter, 0.2J energy, and approximately 5 nsec duration of an individual light pulse spike is produced. Author

N76-26481# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER ANALYSIS OF FOUR CHANNEL X-RAY MICROSCOPY IMAGES TO OBTAIN SOURCE AND SPECTRAL EMISSION DATA ON LASER FUSION TARGETS
T. L. Harper 3 Dec. 1975 28 p refs Presented at the APS Meeting, St. Petersburg, Florida, 10-14 Nov. 1975 Revised
(Contract W-7405-eng-48)
(UCRL-77075-Rev-1; Conf-751130-15) Avail: NTIS HC $4.00

A description is given of how a typical channel microscope experiment is recorded and processed. The computer code MISE is described. Seventeen figures showing various results are given. NSA

N76-26482# California Univ., Livermore. Lawrence Livermore Lab.
X-RAY MICROSCOPY OF LASER FUSION TARGETS IN FOUR ENERGY BANDS FROM 0.7 TO 4.0 keV
M. J. Boyle, F. D. Seward, T. L. Harper, L. N. Koppel, K. J. Pettipiece, and H. G. Ahlstrom 15 Oct. 1975 19 p Presented at APS Meeting, St. Petersburg, Florida, 10-14 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77082; Conf-751130-22) Avail: NTIS HC $3.50

A grazing X-ray microscope was shown to be able to photograph the X-ray emission from laser-produced plasmas between 0.8 and 4.0 keV with a spatial resolution of approximately 3 microns. The calibration of the X-ray mirror energy response functions and the X-ray film allow absolute measurements of the spatial and spectral distribution of the X-ray emission from laser fusion targets. NSA

N76-26483# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY ABSORPTION BY LASER FUSION TARGETS DETERMINED BY ION CALORIMETRY
V. C. Rupert, S. R. Gunn, and J. F. Holzrichter 6 Oct. 1976 34 p Presented at APS Meeting, St. Petersburg, Fla., 10 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77068; Conf-751130-23) Avail: NTIS HC $4.00

The absorbed energy determined by the ion calorimeters was used as a basis for computations of the target behavior. Both neutron yield and X-ray spectra thus obtained were in agreement with the measured values within the precision of both calculations and experiments. Some results are described. NSA

N76-26484# California Univ., Livermore. Lawrence Livermore Lab.
ENERGY STORAGE AND POWER CONDITIONING SYSTEM FOR THE SHIVA LASER
G. R. Allen, W. L. Gagnon, P. R. Rupert, and J. B. Trenholme

12 Nov. 1975 6 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego
(Contract W-7405-eng-48)
(UCRL-77499; Conf-751125-4) Avail: NTIS HC $4.50

An optimal energy delivery system for the world's largest glass laser system has been designed based on computer modeling and operation of laser hardware. Components of the system have been tested on operating lasers at LLL. The Shiva system is now under construction and will be completed in 1977. The energy supply described here will provide cost-effective, reliable power and facilitate the gathering of data in pursuit of controlled thermonuclear reactions. Author (ERA)

N76-26485# California Univ., Livermore. Lawrence Livermore Lab.

COMPOUND ELLIPSOIDAL FOCUSING SYSTEM FOR FUSION LASERS

S. S. Glaros and A. J. Glass 12 Nov. 1975 8 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 17-21 Nov. 1976
(UCRL-77249; Conf-751125-10) Avail: NTIS HC $4.50

Isentropic compression of laser fusion targets requires highly uniform illumination over the entire target surface, and near normal incidence. For a two beam laser, this is best achieved using a fast catadioptric system. In designing such a system, the total thickness of refracting material must be minimized to avoid loss of optical quality through small scale self focusing. Such a system is being fabricated for use with the ARGUS laser. It consists of a pair of nested ellipsoidal reflectors, coupled with an aspheric doublet refracting element which provides uniform illumination for the specified laser bean profile. Author (ERA)

N76-26486# Boeing Scientific Research Labs., Seattle, Wash.

CRITICAL SCATTERING OF LASER LIGHT BY THIN FLUID FILMS Technical Progress Report, 1 Feb. 1975 - 31 Jan. 1976

R. Mockler and W. OSullivan 1975 10 p refs
(Contract E(11-1)-2203)
(COO-2203-4) Avail: NTIS HC $4.50

Accomplishments are presented of a program to develop new techniques and approaches to the study of the physical behavior of fluids near second-order phase transitions. Among the accomplishments of the program was the first application of photon autocorrelation techniques to the study of light scattered from microspheres diffusing in critical fluids, from which the behavior of the shear viscosity of a fluid in the critical regime was inferred; the development of the fluid-filled Fabry-Perot etalon, which led to the first measurement of the anomalous index of refraction of a critical fluid; and work on Brownian motion in critical and normal fluids leading to the development of a new model interpretation of Rayleigh scattering studies on critical fluids in general, the Dynamic or Diffusing Droplet Model. Progress in the development of a Brillouin scattering spectrometer system is also discussed. ERA

N76-26487# California Univ., Livermore. Lawrence Livermore Lab.

PULSATED MOLECULAR NITROGEN LASER EMITTING ULTRAVIOLET

J. P. Girardeau-Montaut, M. Roumy, J. Hamelin, and L. Avan 18 Oct. 1971 8 p refs Transl. into ENGLISH from C. R. Hebd. Seances Acad. Sci., Ser B (France), no. 273, p 725-728 Sponsored by ERDA
(UCRL-Trans-10751) Avail: NTIS HC $3.50

A laser effect was obtained in molecular nitrogen by electronic pumping. The emission wave length is 3371 A and corresponds to the transition C3II/sub u/yields B3II/sub g/ of the second positive band. The power emitted is in the vicinity of 10kW and the light impulse has a duration of about 5 ns. Author (NSA)

N76-26488# California Univ., Livermore. Lawrence Livermore Lab.

CALCULATION OF THE TOTAL POWER EMITTED AT 3,371 A BY A PULSED N2 LASER WITH TRANSVERSE EXCITATION

J. P. Girardeau-Montaut and C. Girardeau-Montaut 13 Mar. 1972 7 p refs Transl. into ENGLISH from C. R. Hebd. Seances Acad. Sci., Ser. B. (France), no. 274, p 740-743 Sponsored by ERDA
(UCRL-Trans-10750) Avail: NTIS HC $3.50

The calculation of the total power emitted at 3371 A by a pulsed molecular nitrogen laser was made. The main steps of the process are given and numerous points of the method proposed first by Jerry then by Ali, Kolb and Anderson were adapted to this particular case. The result was compared to the signal observed by means of a photodiode under identical experimental conditions. Author (NSA)

N76-26489# California Univ., Livermore. Lawrence Livermore Lab.

PREPARATION OF A LASER AMPLIFIER REACHING A POWER OF 50 MW AT 3371 A IN MOLECULAR NITROGEN

J. P. Girardeau-Montaut, M. Roumy, J. Hamelin, and L. Avan 28 Feb. 1972 7 p refs Transl. into ENGLISH from C. R. Hebd. Seances Acad. Sci. Ser. B (France), no. 274, p 607-610 Sponsored by ERDA
(UCRL-Trans-10749) Avail: NTIS HC $3.50

A new series of experiments on transverse electronic pumping of molecular nitrogen permitted the obtaining of an emission power close to 50 MW at 3371 A. From the results obtained with the two laser cells, of 1 m and 0.5 m in length, the gain in amplification was evaluated at 20 db. The duration of the emission is of the order of 2 ns. Author (NSA)

N76-26490# California Univ., Livermore. Lawrence Livermore Lab.

LASER IRRADIATION OF PARYLENE DISKS WITH A 1.06 MICRON LASER

R. A. Haas, D. W. Phillion, M. J. Boyle, H. N. Kornblum, and V. C. Rupert 10 Dec. 1975 26 p refs Presented at the APS Meeting, Saint Petersburg, Fla., 10 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77073-Rev-1; Conf-751130-21) Avail: NTIS HC $4.00

Parylene disks supported on glass stalks were irradiated with 1.06 mu m wavelength laser light pulses focused to flux intensities in the range from 10 to the 15th power to 10 to the 17th power W/sq cm. According to photodiode measurements the fraction of laser light absorbed, 25 to 50 percent, increased slightly as the laser intensity was increased. However, box calorimeter measurements implied that the fraction absorbed was approximately 30 percent and insensitive to irradiation intensity. Some X-ray spectra are discussed. NSA

N76-26491# Wisconsin Univ., Madison. Dept. of Chemical Engineering.

CHEMICAL LASER STUDIES Final Report, 1 Feb. 1971 - 30 Jun. 1975

J. Ray Bowen Oct. 1975 54 p refs
(Grant AF-AFOSR-2033-71; AF Proj. 9538)
(AD-A019683; AFOSR-75-1662TR) Avail: NTIS CSCL 20/5

Pressure limits of detonations in hydrogen-chlorine and hydrogen-chlorine-40% argon mixtures were established experimentally. At 300 K no mixture of hydrogen, chlorine and argon could be detonated below 16 torr. Replacement of excess hydrogen with argon considerably lowered the pressure limits. Replacement of excess chlorine with argon had the reverse effect. A method was proposed to predict pressure limits, if a limit for one mixture composition and the variation of the characteristic blast wave radius for the detonation with system pressure and composition is known. Measured detonation velocities were all significantly above the theoretical Chapman-Jouget velocities. Although most of the detonations were overdriven, a significant portion of the differences between experimental and theoretical velocities is due to only a partial thermodynamic equilibrium at the detonation end state. Detonations in hydrogen-chlorine and hydrogen-chlorine-argon mixtures exhibited an irregular tridimensional structure on the soot records. The cell size decreased with pressure. GRA

N76-26492# Washington Univ., Seattle. Aerospace Research Lab.

A FLUID MECHANICAL LIGHT GUIDE Interim Report

Walter H. Christiansen and Adam P. Bruckner 1975 38 p refs

(Grant AF-AFOSR-2650-74; AF Proj. 9781)
(AD-A019568; AFOSR-75-1667TR) Avail: NTIS CSCL 20/5

It is shown that a beam of light can be deflected continuously through large angles along a curved path using the gas flow from a convergent-divergent nozzle sector whose throat lies on the arc of a circle. The amount of deflection depends on the included angle of the nozzle sector and on the density gradients created by the expanding gas flow. For a 360 deg included angle the beam can in principle be bent into a closed path with a radius of the order of a few tens of centimeters. Nozzle sectors with included angles of 30 deg and 180 deg are studied both theoretically and experimentally. GRA

N76-26493# Rockwell International Corp., Canoga Park, Calif. Rocketdyne Div.
LIQUID AND GASEOUS REACTANTS FOR ADVANCED CHEMICAL LASERS Final Report, 1 Jul. 1974 - 28 Feb. 1975
Lawrence S. Forman and John F. Hon 1 Apr. 1975 224 p refs
(Contract N60921-74-C-0371)
(AD-A019207; R-9689) Avail: NTIS CSCL 20/5

This report presents the results of a program conducted to study and demonstrate liquid and gaseous reactants for use in advanced DF chemical lasers. Included within this program was the careful screening of numerous potential laser reactants with rankings based on predicted performance and handling features: combustion tests of six carefully selected attractive advanced reactant combinations, a ranking of numerous advanced cavity fuels, and the analytical comparison of four candidate advanced DF chemical laser systems. Author (GRA)

N76-26494# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EXPERIMENTAL OBSERVATIONS OF THERMAL-BLOOMING COMPENSATION USING A DEFORMABLE-MIRROR SYSTEM
Charles A. Primmerman and Daniel G. Fouche 20 Nov. 1975 27 p refs
(Contract F19628-76-C-0002; ARPA Order 600; AF Proj. 6E20)
(AD-A019465; LTP-30; ESD-TR-75-317) Avail: NTIS CSCL 20/5

A laboratory experiment has demonstrated the effectiveness of compensating for forced-convection-dominated CW thermal blooming by using a deformable mirror to add phase corrections to the laser beam. In agreement with theoretical predictions, the peak focal-plane irradiance has been increased by a factor of 3 under severely bloomed conditions. Author (GRA)

N76-26495# Air Force Weapons Lab., Kirtland AFB, N.Mex.
X-RAY CONVERSION EFFICIENCY OF A CO2 LASER PRODUCED POLYETHYLENE PLASMA Final Report
Leslie L. McKee, III, Erskine J. T. Burns, and Richard A. Lindstrand Dec. 1975 85 p refs
(AD-A019651; AFWL-TR-75-204) Avail: NTIS CSCL 20/9

A high power CO2 laser (50 J in a 50-ns-wide pulse) was used to produce a plasma by irradiating a plane target. The X-ray emission characteristics of this laser-produced plasma were studied to check the utility of such a plasma as an X-ray source for simulation purposes. The reflectivity of the incident 10.6-micrometer-wavelength laser radiation by the laser-produced plasma was also investigated. The experimental results were analyzed using the theory for laser-produced plasmas. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N76-26496 British Library Lending Div., Boston Spa (England).
TURBO-COMPRESSORS
H. Schubert [1975] 29 p refs Transl. into ENGLISH from Ver. Deut. Ing. Z. (Dusseldorf), v. 117, no. 15/16, 1975 p 752-768
(BLL-NEL-TT-2654-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.

A literature survey on turbo-compressors, covering work completed in 1973-1974, was presented. Research was primarily concentrated on the improvement of prediction methods for compressor characteristics and hence on the improvement of the knowledge of the flow processes in the individual compressor stages. Since an accurate calculation of the flow in the form of a general solution is not yet possible, the aggregate problem of the three-dimensional frictional flow of a compressible medium within the compressor is treated by splitting it up into mutually matched partial problems. A total of 560 references were quoted. Y.J.A.

N76-26497 British Library Lending Div., Boston Spa (England).
INFLUENCE OF MATERIAL STRUCTURE ON THE OPERATIONAL PROPERTIES OF HIGHLY STRESSED STEAM TURBINE COMPONENTS
K. H. Mayer and W. Riess [1975] 11 p refs Transl. into ENGLISH of report from German conf. Presented at VGB Congr., Power Stations, 16-18 Sep. 1975, Paper III/2
(BLL-CE-Trans-6875-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.

On the basis of the principal material used in conventional steam turbine construction, 1% CrMoV steel, which is capable of assuming a wide variety of structural forms depending on the dimensions, heat treatment, and chemical composition, the question of the structural form to be aimed at in order to meet these stress conditions in the case of shafts, housing, and turbine bolts is considered. Author

N76-26498 British Library Lending Div., Boston Spa (England).
DYNAMIC INVESTIGATION OF DRIVES OF METALLURGICAL MACHINES CONTAINING SPATIAL PLANETARY MECHANISMS
Yu. B. Chechulin, V. I. Sokolovskii, Yu. V. Pesin, and A. A. Vinogradova [1975] 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 6, 1975 172-177
(BLL-M-25243-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A procedure is proposed for compiling equations for the movement of a drive with a spatial planetary toothed mechanism with allowance for the torsional pliability of the satellite connections and the inertia of the masses of components performing the planetary movement. A method is examined for constructing a dynamic replacement scheme of a drive containing a spatial planetary mechanism on the basis of an abstract mathematical model obtained by using Lagrange equations. The results are presented of the application of the proposed procedure for the dynamic investigation on an electronic digital computer of a tube cold-rolling mill with a rotating stand. Author

N76-26499 Florida Univ., Gainesville.
THE APPLICATION OF POLE-ZERO PLACEMENT IN THE DESIGN OF MECHANICAL SYSTEMS Ph.D. Thesis
Yogendra Purshottam Kakad 1975 168 p
Avail: Univ. Microfilms Order No. 76-12227

In general, a dynamical system is designed so that it has certain desired response characteristics when it is subjected to an arbitrary input. These response characteristics may be given in terms of natural frequencies of the system, rise time, peak time and over-shoot. However, the response characteristics depend on the pole-zero configuration of the transfer function of the system input, output pair. A method to synthesize control systems with a view to achieve the desired pole-zero placement was developed. It is called the differential synthesis technique. It is a design optimization method, and is used in synthesizing physically realizable systems. The method found to be successful as shown in the case of two systems was considered. The two systems considered for optimization, were a multi-input, multi-output system and a single-input, multi-output system. The multi-input, multi-output system considered is a high speed aircraft system. The single-input, multi-output nonlinear system considered is a torsional mechanical system. Dissert. Abstr.

N76-26500 Florida Univ., Gainesville.
THE CLOSED FORM SYNTHESIS OF SPRING PARAMETERS TO BALANCE GIVEN FORCE FUNCTIONS IN PLANAR MECHANISMS Ph.D. Thesis

Gary Kreider Matthew 1975 161 p
Avail: Univ. Microfilms Order No. 76-12092

The potential energy storage capabilities of linear springs were integrated with the nonlinear motion of mechanisms to provide accurate approximation of desired counter-loading functions. Established techniques of kinematics were modified for the generation of both the analytical techniques and design procedures applied to springs. As many machine processes are dominated in their operating characteristics by large internal load variations, a reduction of such variations must enhance overall machine performance, yielding improved relative phasing and the ability to use smaller primary drive units. Proper employment of optimization concepts is discussed relative to analytical techniques. Several examples of spring synthesis are thoroughly examined and recommendations given for future investigations. Finally, an interactive computer program is shown which will handle all developed analytics. Dissert. Abstr.

N76-26501 Columbia Univ., New York.
KINEMATIC SYNTHESIS OF MECHANISMS WITH PRESCRIBED ENTIRE-MOTION CHARACTERISTICS Ph.D. Thesis
Ting Wu Lee 1975 296 p
Avail: Univ. Microfilms Order No. 76-12761

An investigation is presented of analytical methods for the determination of entire-motion characteristics of small-scale mechanism systems (in which the parameters are sufficiently few that an algebraic approach is feasible). The development of discrete (combinatorial) optimization techniques, in particular, heuristic algorithms for the large-scale kinematic and dynamic optimization of mechanisms and mechanical devices is also investigated. As an illustration of the development of algebraic methods, the entire-motion characteristics of geared five-bar mechanisms were studied. These include the determination of rotatability of the cranks, transmission-angle optimization and the preparation of design charts. A group of six practical design problems were selected and solved by heuristic methods developed in this dissertation. These mechanisms and mechanical devices are believed to be representative of many of the more important types of mechanism design problems encountered in practice. Dissert. Abstr.

N76-26502 Wisconsin Univ., Madison.
A STUDY OF THE DYNAMIC INSTABILITIES OF THE APEX SEAL AND THE CHATTER PHENOMENA IN WANKEL ROTARY ENGINES Ph.D. Thesis
Yavuz Besorak 1975 203 p
Avail: Univ. Microfilms Order No. 76-6066

Trochoid surface chatter in the Wankel Engine is investigated. Friction at the seal-trochoid interface is first described. The state of the art in eliminating chatter is then reviewed. Dynamic forces on the apex seal are studied and the oscillatory modes of the shaft are investigated. A two dimensional approach to the analysis of friction induced oscillations of the slider is introduced. The possibility of contact force variation as a cause of the apparent variation of the sliding coefficient of friction is discussed. The geometry of contact between the seal and the trochoid surface is analyzed for self-locking possibilities, and a criterion for the maximum coefficient of friction to eliminate self-locking is derived. A mathematical model is developed for the two dimensional oscillations of the seal induced by frictional sliding at the trochoid surface. Finally an experimental study of chatter was undertaken on the engine under motoring conditions. Dissert. Abstr.

N76-26503 Pennsylvania Univ., Philadelphia.
FORCED AND SELF-EXCITED VIBRATION OF TRANSONIC TURBINE CASCADES Ph.D. Thesis
Ronald Pigott 1975 346 p
Avail: Univ. Microfilms Order No. 76-12323

The aerodynamic damping and the excitation forces for transonic turbine cascades were determined including the influence of the upstream stator. The governing equations were first transformed into a system of unsteady perturbation equations based upon the known steady state solution for the same cascade geometry at the stationary position. The time-marching technique together with the finite area approximation were employed to obtain a rigorous numerical solution for the case where the cascade represents a row of identical free-standing blades. The stator influence was included by modifying the axial and tangential momentum on the upstream boundary consistent with the effect of the pressure and density perturbations at the stator exit. A numerical stability analysis for the finite area approach is presented and it is shown that the time increment in the time-marching scheme must be reduced as the smoothing is reduced. Dissert. Abstr.

N76-26504 Florida Univ., Gainesville.
SYNTHESIS AND ANALYSIS OF SPHERICAL SIX-BAR MECHANISMS Ph.D. Thesis
Dennis Lee Riddle 1975 190 p
Avail: Univ. Microfilms Order No. 76-12113

The synthesis of spherical mechanisms is considered along with the formulation of the necessary tools. These tools are the curvature transformation and the inversion principle which allow closed-form design of multilink mechanisms for three, four, and five multiply separated positions. Twelve solvable problems are tabulated with an emphasis on the reduction of parameters for motion specification. The curvature transformation is extended to include geometric or time base motion problems. More than 20 detailed design procedures are presented for the spherical four-, five-, and six-link mechanisms. The analysis of spherical mechanisms is presented in terms of two complementary formulations. The first provides for translational and angular evaluation of multilink mechanisms. This analysis is established by means of two-link chains known as dyads. The second treats the input-output equation algebraically. This format yields the evaluation of multiple closure branches simultaneously. Dissert. Abstr.

N76-26505 California Univ., Davis.
THE SEMI-ACTIVE REGULATOR Ph.D. Thesis
Adam Siebenhaar 1975 137 p
Avail: Univ. Microfilms Order No. 76-14235

For linear constant parameter systems, the control synthesis procedure of the semi-active regulator problem can be related to the design of linear optimal control systems with a quadratic performance index. Semi-active control generally exhibits a multiple mode operation. Modes during which absolute controllability of some or all state variables is lost are commonly encountered, yet the overall system is stable if during the uncontrollable modes the eigenvalues of the open loop system have either negative real parts or are purely imaginary. The semi-active controller is sensitive to measurement and system input noise, a problem which can be solved by applying a filtering scheme based on the Kalman Filter. The developed theory is successfully applied to a sample problem. Dissert. Abstr.

N76-26506# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 JANUARY - 31 MARCH 1976
31 Mar. 1976 76 p refs
(DME/NAE-1976(1); ISSN-0047-9055) Avail: NTIS HC $5.00

Wind tunnel stability testing methods and safe handling of jet fuels are discussed. For individual titles, see N76-26507 through N76-26508.

N76-26507 National Aeronautical Establishment, Ottawa (Ontario). Unsteady Aerodynamics Lab.
RECENT ADVANCES IN TECHNIQUES FOR DYNAMIC STABILITY TESTING AT NAE
Orlik-Rueckemann *In* Natl. Res. Council of Canada Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 31 Mar. 1976 p 1-22 refs Presented at Symp. on Unsteady Aerodyn., Ariz. Univ., Tucson, Mar. 1975 (For availability see N76-26506 17-37)

Several new experimental techniques developed over the past few years include: dynamic half model experiments at moderate angles of attack, dynamic interference experiments with two oscillating models, oscillatory experiments on models with simulated exhaust plume, dynamic cross coupling experiments and vertical acceleration experiments. In each case a brief description is given accompanied by a discussion of the rationale

behind the development of the technique and an indication of its potential applications. Author

N76-26508 Division of Mechanical Engineering, Ottawa (Ontario). Fuels and Lubricants Lab.
JET FUEL HANDLING AND SAFETY
L. Gardner *In* Natl. Res. Council of Canada Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab. 31 Mar. 1976 p 23-35 refs (For availability see N76-26506 17-37)

In Canada two types of jet fuel predominate both of which are required because of climatic conditions. While the wide cut fuel can from theoretical considerations be considered a more flammable fuel, under practical conditions the hazards associated with each are quite similar and stringent safety precautions have to be applied with both fuels. Recognizing the hazards of electrostatic charging Canada has adopted the use of a static dissipator additive to control the problem. In addition to fire safety fuel handling requires careful attention to avoid contamination of fuel, which is another safety measure. Quality control of the fuels from refinery to the aircraft and the removal of solid contaminants and water is essential to obtain safe aircraft operation. Author

N76-26509*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN EVALUATION OF GREASE BALL BEARING LUBRICANTS IN VACUUM
K. E. Demorest and E. L. McMurtrey Apr. 1976 20 p refs (NASA-TM-X-73310) Avail: NTIS HC $3.50 CSCL 13I

Because many future spacecraft will require mechanisms to operate for long periods of time in environments which are inimical to most bearing lubricants, a series of tests has been started to evaluate 25 grease type lubricants in R-4 size bearings in vacuum at ambient temperature for a 1 year period. Four repetitions of each test are made to provide statistical samples. These tests will be used to select from two to five lubricants for 5 year tests in the same environment. At the present time fifteen test sets have been completed and five sets are being tested. The best results to date have been obtained with perfluoropolyether greases. Author

N76-26510*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MICROECONOMIC ANALYSIS OF MILITARY AIRCRAFT BEARING RESTORATION
Gerald F. Hein 1976 20 p refs Presented at Bearing Restoration by Grinding Seminar, St. Louis, 20-21 May 1976; sponsored by Army Aviation Systems Command and NASA, Lewis
(NASA-TM-X-73439; E-8728) Avail: NTIS HC $3.50 CSCL 13I

The risk and cost of a bearing restoration by grinding program was analyzed. A microeconomic impact analysis was performed. The annual cost savings to U.S. Army aviation is approximately $950,000.00 for three engines and three transmissions. The capital value over an indefinite life is approximately ten million dollars. The annual cost savings for U.S. Air Force engines are approximately $313,000.00 with a capital value of approximately 3.1 million dollars. Author

N76-26511*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
FLUID VALVE ASSEMBLY Patent Application
William C. Huber, inventor (to NASA) Filed 27 May 1976 16 p
(NASA-Case-MSC-12731-1; US-Patent-APPL-SN-690816) Avail: NTIS HC $3.50 CSCL 13K

A valve assembly for controlling the flow of fluids between the inlet and outlet of a fluid valve is described. The valve assembly is comprised of a barrier element in the body of the valve with a porous portion for providing fluid communication between the valve inlet and outlet. The valve assembly is also comprised of a sealing element in the valve body which is movable, relative to the barrier element between a first position, in which fluid flow through the porous portion of the barrier element is sealed preventing fluid communication between the valve inlet and outlet, and a second position, in which the porous portion is unblocked, permitting fluid communication between the valve inlet and outlet. NASA

N76-26512*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF BALL AND ROLLER BEARINGS RESTORED BY GRINDING
R. J. Parker, E. V. Zaretsky, and S. M. Chen (Army Aviations Systems Command, St. Louis) 1976 35 p refs Presented at Bearing Restoration by Grinding Seminar, St. Louis, 20-21 May 1976; sponsored by Army Aviation Systems Command and NASA, Lewis
(NASA-TM-X-73440; E-8728b) Avail: NTIS HC $4.00 CSCL 13I

The restoration by grinding of those rolling element bearings which are currently being discarded at aircaft engine and transmission overhaul is considered. Three bearing types were selected from the UH-1 helicopter engine and transmission for the pilot program. Groups of each of these bearings were visually and dimensionally inspected for suitability for restoration. A total of 250 bearings were restored by grinding. Of this number, 30 bearings from each type were endurance tested to a TBO of 1600 hours. No bearing failures occurred related to the restoration by grinding process. The two bearing failures which occurred were due to defective rolling elements and were typical of those which may occur in new bearings. The restorable component yield to the three groups was in excess of 90 percent. Author

N76-26513*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF 75 MILLIMETER-BORE ARCHED OUTER-RACE BALL BEARINGS
Harold H. Coe and Bernard J. Hamrock 1976 23 p refs Proposed for presentation at Joint Lubrication Conf., Boston, 5-7 Oct. 1976; sponsored by ASME and Am. Soc. of Lubrication Engrs.
(NASA-TM-X-73442; E-8504) Avail: NTIS HC $3.50 CSCL 13I

An investigation was performed to determine the operating characteristics of 75-mm bore, arched outer-race bearings, and to compare the data with those for a similar, but conventional, deep groove ball bearing. Further, results of an analytical study, made using a computer program developed previously, were compared with the experimental data. Bearings were tested up to 28,000 rpm shaft speed with a load of 2200 N (500 lb). The amount of arching was 0.13, 0.25, and 0.51 mm (.005, .010, and .020 in.). All bearings operated satisfactorily. The outer-race temperatures and the torques, however, were consistently higher for the arched bearings than for the conventional bearing. Author

N76-26514*# Pratt and Whitney Aircraft, East Hartford, Conn.
EXPERIMENTAL STUDY OF TRANSIENT DYNAMICS OF A FLEXIBLE ROTOR Final Report
D. H. Hibner and D. F. Buono Washington Jun. 1976 45 p (Contract NAS3-18523)
(NASA-CR-2703; PWA-5333) Avail: NTIS HC $4.00 CSCL 21E

The results of an experimental program to investigate the transient response of a flexible rotor are presented. The program consisted of a series of tests conducted on a rig with a rotor designed to operate above its first bending critical speed. The purpose of the tests was to obtain experimental data on the transient behavior of a flexible rotor under conditions simulating those which might occur in a jet aircraft engine. The scope of the program included tests to measure the response of both balanced and unbalanced rotors during steady-state operation, acceleration, deceleration, and simulated blade loss. Author

N76-26515*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL DYNAMIC STIFFNESS AND DAMPING OF EXTERNALLY PRESSURIZED GAS-LUBRICATED JOURNAL BEARINGS
David P. Fleming, William J. Thayer, and Robert E. Cunningham Washington Jun. 1976 28 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-8270; E-8636) Avail: NTIS HC $4.00 CSCL 13I

A rigid vertical shaft was operated with known amounts of

unbalance at speeds to 30,000 rpm and gas supply pressure ratios to 4.8. From measured amplitude and phase angle data, dynamic stiffness and damping coefficients of the bearings were determined. The measured stiffness was proportional to the supply pressure, while damping was little affected by supply pressure. Damping dropped rapidly as the fractional frequency whirl threshold was approached. A small-eccentricity analysis overpredicted the stiffness by 20 to 70 percent. Predicted damping was lower than measured at low speeds but higher at high speeds. Author

N76-26516*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF THE GAS-LUBRICATED FLAT-SECTOR-PAD THRUST BEARING
Izhak Etsion Washington Jun. 1976 29 p refs
(NASA-TN-D-8220; E-8623) Avail: NTIS HC $4.00 CSCL 13I

A flat sector-shaped pad geometry for a gas-lubricated thrust bearing is analyzed considering both the pitch and roll of the pad. It is shown that maximum load capacity is achieved when the pad is tilted so as to create uniform minimum film thickness along the pad trailing edge. Performance characteristics for various geometries and operating conditions of gas thrust bearings are presented in the form of design curves, and a comparison is made with the rectangular slider approximation. It is found that this approximation is unsafe for practical design, since it always overestimates load capacity. Author

N76-26517*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMPLIFIED SOLUTION FOR POINT CONTACT DEFORMATION BETWEEN TWO ELASTIC SOLIDS
David E. Brewe and Bernard J. Hamrock Washington Jun. 1976 8 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TM-X-3407; E-8711) Avail: NTIS HC $3.50 CSCL 13I

A linear-regression by the method of least squares is made on the geometric variables that occur in the equation for point contact deformation. The ellipticity and the complete eliptic integrals of the first and second kind are expressed as a function of the x, y-plane principal radii. The ellipticity was varied from 1 (circular contact) to 10 (a configuration approaching line contact). These simplified equations enable one to calculate easily the point-contact deformation to within 3 percent without resorting to charts or numerical methods. Author

N76-26518# Oak Ridge National Lab., Tenn.
PREPARATION AND EXTRUSION OF MULTIFILAMENTARY NbTi CONDUCTOR BILLETS
W. A. Fietz, R. E. McDonald, and J. R. Miller 1975 6 p Presented at the Sixth IEEE Symp. on Engl. Probl. of Fusion Res., San Diego, Calif. 17 Nov. 1975 Sponsored by ERDA
(CONF-751125-38) Avail: NTIS HC $4.50

In a cooperative program with industrial superconducting wire manufacturers for the purpose of studying billet preparation and extrusion, a total of twenty billets were assembled. Fourteen of these contained no superconductor but were dummy billets to evaluate methods of stacking to achieve the best packing density. These billets were not extruded but were sectioned transversely and longitudinally for evaluation of billet preparation techniques. The remaining six billets were assembled with NbTi stacking elements in a copper/copper nickel matrix using a standard conductor configuration. Two of these billets were instrumented with thermocouples and used to evaluate preheating techniques. The other four were extruded and drawn to finished conductor size for critical current measurement. It is shown that hexagonal stacking elements, contoured billet jackets and hot isostatic pressing resulted in high density uniform billets for extrusion. Rotary forging was found to be unacceptable for billet compacting. Fast billet heating was achieved in both the salt bath and by induction heating, but the induction method gave a more uniform temperature distribution during the heating cycle. Author (ERA)

N76-26519# Sandia Labs., Albuquerque, N.Mex.
WELDED RUPTURE DISC ASSEMBLIES FOR USE IN TRITIUM RESEARCH LABORATORY
R. E. Faltings Jan. 1976 11 p refs
(Contract AT(29-1)-789)
(SAND-75-8300) Avail: NTIS HC $3.50

Welded rupture disc assemblies were investigated and developed in various ranges for probable use by experimenters in their activities in the Tritium Research Laboratory at Sandia Laboratories, Livermore. It is indicated that currently welded rupture disc assemblies with appropriate testing and installation by certified pressure installers may be used in pressure systems in the Tritium Research Laboratory and other areas at SLL. Author (NSA)

N76-26520# Addis Translations International, Woodside, Calif.
METALLURGICAL STUDY OF ELECTRON-BEAM WELDING OF THE ALLOY U-0.2 PERCENT V
C. Prunier, M. Linard, J. Guillaumin, and F. Giraud-Heraud 1974 27 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met. (France), v. 71, no. 7/8, 1974 p 461-473 Sponsored by ERDA
(UCRL-Trans-10975) Avail: NTIS HC $15.00

The effects of welding cycles on U-0.2 percent V alloys involving cooling at high rates from the beta and gamma phases were studied. The results indicate that the welding operation modifies the initial structure obtained by the heat treatment to refine the alpha grain. The weld is decomposed into three primary zones of different metallurgical nature with respect to the particular thermal cycles. Beta-hardenings are characterized by a single beta yields alpha transformation range. In contrast, depending on the cooling law, gamma-hardenings are manifested by one or more transformation anomalies which lead to complex alpha structures, one of which has a maximum hardness and a minimum ductility. Author (NSA)

N76-26521# Addis Translations International, Woodside, Calif.
STUDY OF THE FORGE-ABILITY AND DEFORMATION RESISTANCE OF THE ALLOY U-0.2 PERCENT V BY TORSION TESTS BETWEEN 400 AND 800 C
P. Choquet and C. Prunier 1976 27 p refs Transl. into ENGLISH from J. Nucl. Mater. (Netherlands), v. 57, 1975 p 34-44 Sponsored by ERDA
(UCRL-Trans-10977) Avail: NTIS HC $5.00

The resistance to deformation and the deformation capacity of the alloy U 0.2 wt. percent V between 400 and 800 C for deformation rates between 10-2s-1 and 3.6s-1 were studied by hot torsion. In this temperature range, the alloy exhibits three distinct phases in succession: orthorhombic alpha, tetragonal beta, and body-centered cubic gamma, which behave differently. Two useful ranges were determined for the plastic working of the alloy U 0.2 wt. percent V: the alpha phase above 600 C and the gamma phase. By the theory of plasticity the equivalence between the hot-torsion results and hot-tension results was established and a first rolling pass was simulated. Tensile tests between 600 and 800 C and a rolling test at 600 C demonstrated the justification for the transition between torsion and other modes of deformation. A micrographic study of the structure of test pieces after fracture showed the existence of recrystallization in the alpha phase beginning at 600 C and in the gamma phase, which explains the good workability observed. Author (NSA)

N76-26522# Aerospace Corp., El Segundo, Calif.
MIGRATION OF APIEZON C ON METAL SUBSTRATES UNDER THE INFLUENCE OF TEMPERATURE GRADIENTS: MATHEMATICAL MODEL Interim Report
Alfred A. Fote 30 Dec. 1975 26 p refs
(Contract F04701-75-C-0076)
(AD-A019665; SAMSO-TR-75-300) Avail: NTIS CSCL 07/4

A computer program has been generated that describes the temperature-gradient-induced migration of oil films reported previously. It has been demonstrated that gravitational effects are negligible for such thin films therefore, the results of our earth-based experiments should not differ significantly from results expected in space. The dominant driving forces are due to surface tension effects alone. Author (GRA)

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N76-26523 Wyoming Univ., Laramie.
SOME APPLICATIONS OF EXTREME-VALUE THEORY TO RELIABILITY Ph.D. Thesis
Ronald Virgil Canfield 1975 150 p
Avail: Univ. Microfilms Order No. 76-13515

Knowledge gained through study of the physics of failure indicates that failure of many components may be associated with an extreme value phenomenon. Flaws or imperfections which occur during manufacturing may each represent a potential failure site. Associated with each failure site is a time-to-failure. This collection may be represented as a sample from a population with a given time-to-failure distribution. Component failure occurs at the minimum time-to-failure associated with the failure sites. In addition a component may have more than one mode of failure. Each mode of failure is characterized by a time-to-failure distribution which may be unique. Thus time-to-failure random variable of the component may be given by Z sub n = min Y sub 1 Y sub 2.....Y sub n, where Y sub 1.....Y sub N are the time-to-failure random variables associated with each failure site and are not necessarily identically distributed. The number N is a random variable representing the total number of potential failure sites of all modes. Dissert. Abstr.

N76-26524 Iowa Univ., Iowa City.
FAIL-SAFE OPTIMAL DESIGN OF STRUCTURES Ph.D. Thesis
Pore-Feng Sun 1975 128 p
Avail: Univ. Microfilms Order No. 76-13450

A general fail-safe optimal design problem for structures with fixed geometry is formulated. Structural weight or some other performance index can be used as a cost function. Member stress, buckling load, nodal displacement, and natural frequency constraints on the complete and damaged structures are considered. The design variables are size, moment of inertia, or other mechanical properties of structural members. The structure is discretized and a finite element method is used for structural analysis. An iterative algorithm, based on a generalized steepest descent method, is developed to search for optimal designs. In this optimization process, the cost function, state equations, and inequality constraints are linearized and the dependence of these equations on the state variables is eliminated by solving adjoint equations. Dissert. Abstr.

N76-26525*# Alabama Univ., University. Bureau of Engineering Research.
EVALUATION OF A COMPOSITE MOBILE HOLOGRAPHIC NONDESTRUCTIVE TEST SYSTEM Final Report
Hua-Kuang Liu, Ellis R. Commeens, William D. Hunt, and Larry Whitt Jun. 1976 97 p refs
(Contract NAS8-30479)
(NASA-CR-144349; BER-204-74) Avail: NTIS HC $5.00 CSCL 14D

A simplified theoretical model for the interpretation of the double-exposure holographic interference fringe loci due to the general three-dimensional displacements was derived for the specific composite mobile holographic nondestructive test system. The model, representing a good approximation to a more tedious theoretical result, predicts that a combination of in-plane and out-of-plane displacements of the surface will produce concentric circular-shaped fringe patterns with locations of their center affected by the displacements. Appropriate experiments were designed and carried out for the test of the validity of the theory. These experiments include the taking of double-exposure holograms of in-plane translations and combined in-plane and out-of-plane translations. The simplified model agreed quite well with the experimental results. Experimentally observed effects due to the curvature of the test plate and the variations of the angles of incidence of the laser light suggest that in order for the simplified model to be able to predict the test results more accurately, incidence and reflection of the laser light should be chosen as nearly perpendicular to the surface of the tested object as possible. Author

N76-26526# United Kingdom Atomic Energy Authority, Culcheth (England).
COMPUTER DETERMINATION OF EVENT MAPS WITH APPLICATION TO AUXILIARY SUPPLY SYSTEMS
L. Wredenberg and R. Billinton 1975 10 p refs
(NCSR-R-5) Avail: ERDA Depository Libraries HC $3.50

A method of evaluating the reliability of sequential operations in systems containing standby and alternate supply facilities is presented. The method is based upon the use of a digital computer for automatic development of event maps. The technique is illustrated by application to a nuclear power plant auxiliary supply system. Author (NSA)

N76-26527# United Kingdom Atomic Energy Authority, Culcheth (England).
RELIABILITY OF PNEUMATIC CONTROL EQUIPMENT: A CASE STUDY IN MECHANICAL RELIABILITY
T. R. Moss Aug. 1975 27 p refs
(NCSR-R-4) Avail: ERDA Depository Libraries HC $4.00

A reliability assessment of automatic feedwater control systems to be installed in a nuclear power station indicated relatively high rates of failure from the pneumatic control equipment. The predictions were, however, at variance with the early operating experience of identical prototype systems installed elsewhere, and doubts were cast on the validity of the simple exponential model of failure employed in the assessment. These doubts have been largely substantiated. It is indicated that the level of faults potentially hazardous to the reactors is likely to be about a factor of 10 lower than predicted. It is shown that the failures of equipment employed in the systems are initially distributed according to Weibull functions. A constant rate of failure (i.e., simple exponential distribution) will emerge at some stage but it will be dependent on the randomizing effects of repeated maintenace rather than the chance combination of stress factors normally associated with failures in the useful-life phase. The majority of mechanical systems in industrial situations are also expected to follow Weibull distributions. The factors which cause this appear to be largely determined by the system's normal loading characteristics. An evaluation of the load function and its effect on individual component lifetime is therefore essential if mechanical equipment failure rates are to be predicted theoretically. Author (NSA)

N76-26528# Florence Univ. (Italy). Ist. di Elettronica.
ORGANIZATION OF ACCELERATED LIFE TESTS ON DISCRETE TRANSISTORS
A. Zanini 1974 11 p refs
Avail: NTIS HC $3.50

General requirements are given for planning a system intended to perform accelerated life tests on discrete transistors in order to evaluate the frequency distribution curve of failures. An examination is made of stresses causing progressive degradation in transistors, primarily the junction temperature (due to either ambient temperature or power dissipation), and the collector-base voltage. Test circuits to which these stresses can be applied and which allow the working point of each specimen to be fixed are discussed. The sequence of test cycles is described and transistor parameters to be measured are considered together with the data acquisition system needed for such measurements. ESA

N76-26529# White Sands Missile Range, N.Mex.
GIDEP: AN APPROACH TO COORDINATED DATA COLLECTION AND UTILIZATION
Francis M. Nelson 1976 17 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

The concept, organization, content, and operation of the Government-Industry Data Exchange Program (GIDEP) is described. GIDEP is concerned with data bases in the fields of part, component or material engineering, failure rates, metrology, failure experience, and aircraft maintenance. Service provided by the program are distribution of alerts, urgent data requests, and electronic test equipment support information. ESA

N76-26530# European Space Agency, Frascati (Italy).
THE ESA DATABANK CONTRIBUTION TO SPACECRAFT RELIABILITY
M. Lombardo 1976 27 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $4.00

The ESA-Electronic Components Databank (ESA-ECDB) is dealt with as a space components data file. The main function of the ECDB in the space components field is to provide the history of each component type. A computer stored data file is now being produced, containing information about the use of space components in space projects, their presence in qualified and preliminary parts lists and the problems met by each of them (failures, malfunctions). This data is retrievable both in table form and by means of remote terminals, directly connectable to the central computer either via the telephone switched network or via a dedicated line. Author (ESA)

N76-26531# Royal Aircraft Establishment, Farnborough (England).
THE EUROPEAN SPACE AGENCY SPACE COMPONENTS CO-ORDINATION GROUP (ESA-SCCG) POLICY ON COMPONENT PARTS FOR SPACE APPLICATIONS
J. K. Williams 1976 5 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

The policy of the Space Components Coordination Group is to provide a means of establishing product confidence at the level determined by the requirement of the user. Within these terms this means component parts capable of operating within closely defined limits, in a critical application, in space environment, for a period of seven years and possibly longer without access for maintenance. ESA

N76-26532# AEG-Telefunken, Backnang (West Germany).
SUBCONTRACTOR PARTS POLICY FOR ESA SPACE PROGRAMS
Franz-Rudolf Theis 1976 18 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

Based on the experience gained from a number of space programs sponsored by different customers, some of the major points of parts procurement are discussed and their associated problems pointed out. The major points under discussion include: possible forms of organizational structure for the procurement of parts for a project consisting of one main contractor and several subcontractors; selection of parts taking into consideration reliability and design aspects; difficulties encountered with existing specification systems when procuring parts; and the question of the effectiveness of the required qualification and VOQ tests. Author (ESA)

N76-26533# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PARTS PROCUREMENT SYSTEM FOR AN ESA SPACE PROGRAMME
Malcolm Snowdon 1976 13 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

The current status of parts procurement activities shows clearly that each program lacks a solid base from which to set up a parts procurement system. Much time and effort is lost in attempting to set up a system after contract award. The effect of contractual and technical discussions is a very definite weakening of the objective, to procure reliable parts on schedule at the most economic price. A requirement is stated for an overall parts procurement system which clearly defines the requirements. ESA

N76-26534# British Aircraft Corp. (Operating) Ltd., Bristol (England). Guided Weapons Div.
COMPONENT PROCUREMENT POLICY FOR AN ESA SPACE PROJECT BY A CONTRACTOR
B. E. Ball and P. A. Densley 1976 52 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $4.50

From the experience gained to date in coordinating the procurement of parts for spacecraft programs three main factors emerge which adversely affect the cost effectiveness of the program. Full qualification is cost effective only if conducted with vendors from whom parts are continually procured for European space program use; the Destructive Physical Analyses presently undertaken could be more positive and hence more cost effective if the visual examination under high magnification be conducted at the vendor's facility at the time of the pre-seal visual examination so that any problems or differences of opinion could be resolved before parts are shipped; the GEOS procurement program indicates that the quality and total procurement costs of parts from the U.S. and Europe are similar, but the procurement time is significantly less in Europe and, for future programs, much more positive effort should be made to buy parts from European vendors. Author (ESA)

N76-26535# European Space Research and Technology Center, Noordwijk (Netherlands).
ESA AND PARTS PROCUREMENT. EXPERIENCE GAINED AS A CUSTOMER
H. H. Wessels and L. Adams 1976 42 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $4.00

A short history of ESA involvement in parts activities is presented, and the role of ESA discussed. Tools to control parts and their procurement by a customer are presented based on recent project experience. The active and successful use of support from a well-experienced parts engineer and a laboratory group as an important customer tool is described, noting the use of destructive physical analysis. Speculations are made with regard to future ESA involvement and ESA/contractor cooperation in parts procurement. ESA

N76-26536# Vereinigte Flugtechnische Werke-Fokker G.m.b.H., Bremen (West Germany). Space Div.
A PRODUCT ASSURANCE PROGRAM FOR A NATIONAL SATELLITE
E. Widdows and H. Rouws 1976 22 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

The organization and working methods of the Industrial Consortium Astronomical Netherlands Satellite Product Assurance (PA) are described. The close working relationship between PA, systems design, and configuration control, is underlined, as are the considerable delegation of tasks to the local PA sections and the involvement of PA in the areas of parts, materials, and processes. ESA

N76-26537# General Electric Co., Philadelphia, Pa. Space Div.
PRODUCT ASSURANCE ACTIVITIES FOR LONG-LIFE SPACE PROGRAMS
Paul Dick 1976 24 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

A few product assurance techniques and systems used to evaluate, control, and improve the quality, reliability, and performance of long-life space mission products at reasonable cost are summarized. The essential factors needed to make this possible are dedicated, qualified, and disciplined personnel using proven and controlled parts, materials, processes, procedures, equipment, and facilities with appropriate management and customer visibility. ESA

N76-26538# Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn (West Germany).
SPACECRAFT RELIABILITY - OVER HERE AND OVER THERE: PAST AND FUTURE
H. W. VonGuerard 1976 31 p refs Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $4.00

The impact of operations research on reliability analysis is discussed. The trend leads away from mathematical modeling back to means concerned with reliability assurance rather than prediction. A more unifying philosophy may be envisaged when all salient facts, from R and D endurance tests to in-flight data,

provide a priori information for Bayesian models of probability of success. ESA

N76-26539# TRW Systems Group, Redondo Beach, Calif.
THE ROLE OF PRODUCT ASSURANCE IN IMPROVING SOFTWARE RELIABILITY
F. S. Ingrassia and T. A. Thayer 1976 16 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

The contributions of product assurance discipline to the improvement of software reliability at various stages of product development are examined. Necessary tools and procedures for implementing this discipline and enforcing adherence are discussed, and examples of specific tools and techniques and benefits derived from their use are provided. Current experience in employing modern product assurance techniques on a large, real-time software development project is presented. A view of software product assurance's role in the future is offered, giving consideration to small as well as large software systems. Author (ESA)

N76-26540# Thomson-CSF, Paris (France). Div. Tubes Electroniques.
IMPLEMENTATION OF ESA PRODUCT-ASSURANCE REQUIREMENTS IN THE DESIGN AND PRODUCTION OF HIGHLY RELIABLE X-BAND TRAVELING-WAVE TUBES FOR COMMUNICATIONS SATELLITES
R. L. Metivier and D. R. Madden (ESTEC) 1976 27 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $4.00

The ambitious objective of an MTTF of one million hours, set in 1971 by ESRO for a traveling wave tube delivering 20 watts in X-band, with high efficiency, is now well on the way to being demonstrated. Past experience is described in brief, and a summary of life and reliability requirements is given. Different aspects of life and reliability implementation are presented: design aspects, production aspects, resultant production, and reliability demonstration results. Author (ESA)

N76-26541# European Space Research and Technology Center, Noordwijk (Netherlands).
SATELLITE HAZARDS CONTROL
H. Broberg 1976 19 p refs Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

Hazards to satellites are dealt with as a separate subject, related however to reliability and safety. The hazard concept is treated in terms of risks during the phases of a project to satellite hardware from environment, operators, interfaces, etc. The detection of risks via energy considerations is discussed. It is suggested that for the immediate future more emphasis must be given to establishing a planned approach to the practical control of hazards rather than increasing the degree of sophistication in other already well established areas of product assurance. Author (ESA)

N76-26542# Hawker Siddeley Dynamics Ltd., Stevenage (England).
SOME PROPOSALS FOR IMPROVING COST EFFECTIVENESS OF PRODUCT ASSURANCE
G. P. Sibilia 1976 14 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

Some of the problems concerning cost effectiveness of product assurance are outlined, and suggestions are made for improvement that could be beneficial across European space industry. ESA

N76-26543# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany).
PRODUCT ASSURANCE FOR COST EFFECTIVENESS - COST EFFECTIVE PRODUCT ASSURANCE
J. H. Levold 1976 7 p refs Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

An integrated product assurance approach, when compared to a historical quality inspection system, is aimed at overall cost effectiveness. It is designed for early detection of deficiencies when corrections can still be made at relatively low cost to the project. The Spacelab approach to unite criticality categories and a scheme of criteria for quality grades is presented. ESA

N76-26544# Societe Nationale Industrielle Aerospatiale, Les Mureaux (France).
COMPONENT POLICY APPLIED DURING DEVELOPMENT OF THE ARIANE LAUNCHER [POLITIQUE COMPOSANTS APPLIQUEE AU COURS DU DEVELOPPEMENT DU LANCEUR ARIANE]
A. Dumont and D. Roux 1976 21 p In FRENCH Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

The general principle and the methodology of the electronic component procurement policy adopted for the Ariane launch vehicle are described. The policy is aimed at obtaining built-in reliability. ESA

N76-26545# Hawker Siddeley Dynamics Ltd., Stevenage (England).
IMPLEMENTATION OF A PRODUCT ASSURANCE PROGRAMME ON AN ESA SPACECRAFT
C. E. DeAth 1976 21 p refs Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

The problems encountered and the possible solutions when implementing and controlling a product assurance program as a prime contractor for an ESA spacecraft are outlined. ESA

N76-26546# AEG-Telefunken, Backnang (West Germany).
IMPLEMENTATION OF CONFIGURATION MANAGEMENT REQUIREMENTS FOR THE OTS SPACECRAFT BY A CO-CONTRACTOR
Karl-Heinz Damm 1976 11 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

An aspect of configuration management procedures for the OTS spacecraft is dealt with. This is a practical documentation method (configuration status list) for the as designed and as built status and the association to the hardware concerned. ESA

N76-26547# Comsat Labs., Clarksburg, Md.
DEVELOPMENT OF PRODUCT ASSURANCE REQUIREMENTS FOR THE INTELSAT SATELLITE SERIES
R. Strauss 1976 25 p refs Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976 Sponsored by Intern. Telecommun. Satellite Organ.
Avail: NTIS HC $3.50

The role of product assurance in the development of the five series of satellites, Intelsat 1 (Early Bird), Intelsat 2, Intelsat 3, Intelsat 4 and 4A, and the forthcoming Intelsat 5, is discussed. Specifically, the evolution of the hard core requirements is reviewed as well as some of the more tangible benefits. Expected trends in the product assurance area vis a vis the Intelsat 5 spacecraft program complete the review. Author (ESA)

N76-26548# Aerospace Corp., Los Angeles, Calif.
THE AEROSPACE CORPORATION EXPERIENCE IN SATELLITE PRODUCT ASSURANCE PROGRAMS
Allan J. Boardman 1976 15 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

An overview is presented of the technical role a centralized engineering group plays in the reliability and product assurance activities of major spacecraft programs. The accumulated experience of this group has justified particular emphasis on several important concepts and practices which are briefly described. These include some specific design, test and analysis considerations that have proven to be effective elements in assuring spacecraft reliability. Author (ESA)

N76-26549# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
THE ROLE OF NATIONAL SPACE AGENCIES IN THE COOPERATION WITH ESA IN THE FIELD OF PRODUCT INTEGRITY

H. A. Schuetz 1976 12 p refs Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

A brief survey is given on the history of product assurance in European space activities, both within ESA and national organizations. In the beginning, the developments were parallel, showed little coordination and were mainly based on American models. In the meantime, however, separate specifications were developed to fit the specific European conditions. The objectives are described which aim at uniform procedures and specifications, and which require cooperation and teamwork. The cooperation between ESA and national organizations covers standardized product assurance documents and procedures for the qualification of components, materials, systems and subsystems; furthermore a direct use of personnel (National Inspectorates) for the industrial control of ESA-contractors as well as the utilization of laboratories and facilities is elaborated. Author (ESA)

N76-26550# Centre National d'Etudes Spatiales, Toulouse (France). Dept. Qualite.
PRODUCT ASSURANCE CONCEPT FOR THE ARIANE SATELLITE LAUNCHER [CONFERENCE SUR LE CONCEPT ASSURANCE PRODUIT RETENU POUR LE LANCEUR DE SATELLITES ARIANE]
Claude Petitdemange 1974 75 p In FRENCH Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $4.50

Based on experience in Ariane launcher development, the requirements for European product assurance procedures are formulated. These requirements are: a European product assurance terminology, a European definition of the product assurance concept, a methodology for obtaining and placing this function, and application procedures. ESA

N76-26551# European Space Research and Technology Center, Noordwijk (Netherlands).
ESA PRODUCT ASSURANCE REQUIREMENTS FOR THE MANNED SPACEFLIGHT PROGRAMME SPACELAB
Lars G. Tedeman 1976 66 p refs Presented at the European Space Prod, Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $4.50

The product assurance requirements for ESA projects have gradually increased in line with the increased complexity of satellites and the requests for longer life. The Spacelab program involves some new aspects which impact the established ESA product assurance baseline requirements. This is due to the manned aspect, i.e. the requirements for a habitable environment. Therefore, additional requirements on materials are imposed such as non-flammable, non-toxic and non-odor. The total safety program is also more emphasized due to the human safety aspect. Author (ESA)

N76-26552# European Space Research and Technology Center, Noordwijk (Netherlands).
LESSONS LEARNED - THE FUTURE?
T. A. Meaker 1976 35 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $4.00

Certain conclusions from the customer viewpoint are presented covering experience gained since the implementation of the European applications satellite programs. Possible future activities are discussed with postulated impacts on product assurance. ESA

N76-26553# European Space Research and Technology Center, Noordwijk (Netherlands).
ESA'S PRODUCT ASSURANCE REQUIREMENTS FOR SCIENTIFIC SPACECRAFT
R. Thomas 1976 21 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

ESA's product assurance requirements are reviewed in the light of competition offered to scientific spacecraft by Spacelab. It is believed that ESA's requirements have grown to such an extent that pruning is necessary whether or not Spacelab materializes. Simplification is required even if this brings a higher incidence of failure in ground test and orbital life. A reduction in parts engineering requirements and in reliability analysis will become essential for scientific programs but materials engineering may become even more important as spacecraft complexity increases. Author (ESA)

N76-26554# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).
EXPERIENCE GAINED IN IMPLEMENTATION OF THE PRODUCT ASSURANCE PROGRAM FOR THE ESA SPACECRAFT COS B
M. vHoegen 1976 20 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

Experience gained from COS-B product assurance is discussed in relation to quality assurance, reliability assurance, and parts procurement. It is noted that close cooperation between product assurance and engineering leads to optimal results. ESA

N76-26555# European Space Agency, Paris (France).
NONDESTRUCTIVE CONTROL OF MATERIALS BY ULTRASONIC TESTS
Noelle Mercier Apr. 1976 103 p refs Transl. into ENGLISH of 'Controle Non Destructif de Materiaux par Ultrasons', ONERA, Paris Report ONERA-NT-232, 1974
(ESA-TT-274; ONERA-NT-232) Avail: NTIS HC $5.50

A bibliographic study of nondestructive control methods of solids by ultrasonic tests and of the ultrasonic emission of a transducer of finite dimension is first presented. The principle of two of these methods is verified experimentally: they should permit the measurement of various physical parameters of solids and the detection of local inhomogeneities. The first method calls upon the analysis of the ultrasonic signal (amplitude and phase) after it has crossed a constant thickness of a metallic specimen. This analysis reveals variations of attenuation and of ultrasonic propagation velocity within the specimen. A good spatial resolution is obtained by using 1-mm-dia probes. The second method leads, thanks to a test rig equipped with broad frequency band electrostatic transducers, to the knowledge of the attenuation law of the specimens as a function of frequency (present range 5 to 15 MHz); from this is deduced a classification of these specimens as regards their granulometry. Author (ESA)

N76-26556# Naval Postgraduate School, Monterey, Calif.
MULTI-PHASE-MISSION RELIABILITY OF MAINTAINED SYSTEMS Ph.D. Thesis
Merlin Gene Bell Dec. 1975 91 p refs
(AD-A020107) Avail: NTIS CSCL 14/4

In a phased mission the functional organization of the system changes at selected times which mark the boundaries of the phases of the mission. Existing methods for analysis of phased missions are modified and extended to permit determination of the reliability of maintained systems. Results are first obtained for the case when maintenance is performed only during a standby period, called the operational readiness phase, during which the system functions solely to maintain its readiness for a later period of active operations, as is the case for strategic weapons and safety devices. These results are then extended to systems which perform complex multi-objective missions to permit assessment of system performance at levels intermediate between total failure and total success. The reliability of systems which are maintained throughout a multi-phase mission is also considered. Two bounds on system reliability are developed--one based on the within-phase reliability of the system and the other on the phase minimal cut sets. Compatible lower bounds on the reliability of phase minimal cut (parallel) systems of independent components with exponential failure and repair times are considered. GRA

N76-26557# George Washington Univ., Washington, D.C. Inst. for Management Science and Engineering.
ESTIMATING RELIABILITY GROWTH USING TIME SERIES ANALYSIS
Nozer D. Singpurwalla, Faiz A. Al-Khayyal, and Victor F. Castellino 8 Dec. 1975 27 p refs
(Contracts N00014-75-C-0729; F33615-74-C-4040; NR Proj. 347-020)
(AD-A019304; Serial-T-326) Avail: NTIS CSCL 14/4

In this paper a method is presented for estimating reliability

growth (or deterioration) using time series analysis. Our method does not call for the specification of a particular model, and estimates the growth in the presence of non-stationarity and periodicity. The procedure is illustrated by considering some binomial failure data generated during the testing of a large system of the U.S. Navy. GRA

N76-26558# California Univ., Los Angeles. Graduate School of Management.
MODIFIED BAYESIAN PROCEDURES IN RELIABILITY TESTING
Bennet P. Lientz Jan. 1976 14 p refs
(Contract N00014-75-C-0266; NR Proj. 049-345)
(AD-A019585) Avail: NTIS CSCL 14/4

The problems and potential of Bayesian and empirical Bayesian procedures in reliability testing are examined. Procedures are developed for the case where the prior distribution is only partially known. The results are then applied to problems in component allocation and error rate analysis in computer networks. Of specific interest in these areas are the differences in component allocation solutions and message routing and loads. GRA

N76-26559# Battelle Columbus Labs., Ohio. Metals and Ceramics Information Center.
SEM/TEM FRACTOGRAPHY HANDBOOK Final Report, Oct. 1973 - Jun. 1975
G. F. Pittinato, A. Phillips, V. Kerlin, and M. A. Russo Dec. 1975 768 p refs Prepared jointly with McDonnell Douglas Astronautics Co., Huntington Beach, Calif.
(Contract DSA900-75-C-1803; F33615-74-C-5004; AF Proj. 7381)
(AD-A020793; MCIC-HB-06; AFML-TR-75-159) Avail: NTIS CSCL 11/6

A SEM/TEM Electron Fractography Handbook was prepared with the primary intent of assisting in service failure analyses. The handbook consists of three separate sections. Section 1 describes the basic techniques used in handling and preparing specimens for electron fractography. Only those techniques that are routinely used in fracture surface analyses are discussed. In Section II of the handbook, the fracture surface characteristics and mechanisms associated with the different fracture modes are examined and illustrated. A discussion is given on the four principal fracture modes: dimple rupture, cleavage, fatigue, and decohesive rupture. Representative SEM and TEM fractographs depicting these fracture modes are also included in this section. Section III contains SEM and TEM electron fractographs of numerous alloys that were fractured under controlled conditions. This atlas of electron fractographs is organized by alloy type, and within each alloy subsection, by the specific test conditions that produced the fracture. GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N76-26560 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 8, NUMBER 3, MARCH 1976
Mar. 1976 94 p refs
(AD-A022497) Avail: NTIS MF $2.25; HC available from Shock and Vibration Information Center, Naval Research Lab., Code 8404, Washington, D. C. 20375. Annual Subscription $40.00
CSCL 20/11

Structural response to vibration and shock loads is considered. Emphasis is on turbulent boundary layer pressure fluctuations and dynamic behavior of elastomers under dynamic loads. For individual titles, see N76-26561 through N76-26562.

N76-26561 Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.
LOW-WAVE NUMBER CONSTANT OF TURBULENT BOUNDARY LAYER PRESSURE FLUCTUATIONS
L. D. Pope *In* Shock and Vibration Inform. Center The Shock and Vibration Dig., Vol. 8, No. 3 Mar. 1975 p 3-10 refs (For availability see N76-26560 17-39)
CSCL 20/11

The average response velocity spectra of infinite and finite plates excited by turbulent boundary layer pressure fluctuations is analyzed. Author

N76-26562 General Dynamics Corp., Groton, Conn. Electric Boat Div.
BEHAVIOR OF ELASTOMERIC MATERIALS UNDER DYNAMIC LOADS
E. C. Hobaica and G. Sweet *In* Shock and Vibration Inform. Center. The Shock and Vibration Dig., Vol. 8, No. 3 Mar. 1975 p 77-88 refs (For availability see N76-26560 17-39)
CSCL 20/11

The state-of-the-art is presented of rubber when it is subjected to small amplitude, sinusoidal stresses. Such dynamic loading responses vary not only with the type of polymer, its stress history, formulation, and method of processing but also with the testing method, frequency used, and temperature. Included in the discussion are viscoelastic behavior and its quantitative description; molecular structure of polymers and its effects on the dynamic mechanical response of elastomers; application of the time-temperature superposition technique to rubber materials; and test methods for determining dynamic behavior. The review is presented from a materials approach and is intended as an introduction and guide to the literature. Author

N76-26563 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 8, NUMBER 2, FEBRUARY 1976
Feb. 1976 103 p refs
(AD-A022496) Avail: NTIS MF $2.25; HC available from Shock and Vibration Information Center, Naval Research Lab., Code 8404, Washington, D. C. 20375. Annual subscription $40.00
CSCL 20/11

Papers are presented dealing with structural response to vibration and shock. Topics discussed include: Galerkin's method for vibration problems, analysis of structural frequency-response data, and effects of vibration of rotors through critical speeds. For individual titles, see N76-26564 through N76-26566.

N76-26564 Waterloo Univ. (Ontario).
USE OF GALERKIN'S METHOD FOR VIBRATION PROBLEMS c64
In Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 8, No. 2 Feb. 1976 p 3-18 refs (For availability see N76-26563 17-39)
CSCL 20/11

Galerkin's method is a technique for obtaining approximate solutions to differential equations for which initial value problems or boundary value problems have been posed. Due to the conditions of periodicity involved in vibrations, boundary value problems are always obtained; therefore, only boundary value problems dealing with vibrations are considered. Author

N76-26565 Institutul Politehnic din Bucharest, (Rumania).
METHODS FOR THE ANALYSIS OF STRUCTURAL FREQUENCY-RESPONSE MEASUREMENT DATA
Mircea Rades *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 8, No. 2 Feb. 1976 p 73-88 refs (For availability see N76-26563 17-39)
CSCL 20/11

An introduction to the graphical analysis of frequency response measurement data is given. The most frequently used data reduction techniques are reviewed, particularly the analysis of vector diagrams. Accuracy with regard to natural frequencies close to each other, nonlinearities, and imperfect mode isolation are also considered. Author

N76-26566 Kobe Univ. (Japan).
VIBRATION OF ROTORS THROUGH CRITICAL SPEEDS
Takuzo Iwatsuba *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 8, No. 2 Feb. 1976 p 89-98 refs (For availability see N76-26563 17-39)
CSCL 20/11

The behavior of the rotor during acceleration and deceleration through critical speeds and to the maximum amplitude and stress of the shaft are examined. Author

N76-26567 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 8, NO. 4
Apr. 1976 81 p refs
(AD-A023597) Avail: NTIS MF $2.25; HC available from Shock and Vibration Information Center, Naval Research Lab., Code 8404, Washington, D. C. 20375. Annual subscription $40.00
CSCL 20/11

Three papers are presented which deal with damping and structural vibration in mechanical drives and devices, shells, cylinders, buildings, bridges, and other structures. Mathematical models of the dynamic responses of these structures to loads and stresses are given. For individual titles, see N76-26568 through N76-26570.

N76-26568 Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
DYNAMIC STABILITY OF ELASTIC IMPERFECTION-SENSITIVE SHELLS
Siegfried Holzer *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 8, No. 4 Apr. 1976 p 3-10 refs (For availability see N76-26567 17-39)
CSCL 20/11

Investigations are presented of the stability of equilibrium of elastic imperfection-sensitive shells subjected to finite aperiodic excitations. The following was studied: (1) the characteristic of the shell that accounts for its sensitivity to disturbances; (2) the stability criteria employed and their common basis; and (3) the application of these criteria to specific problems. The existing dynamic stability criteria are viewed in the framework of Liapunov's theory of stability of motion. A complete bibliography on the subject is given. Author

N76-26569 Waterloo Univ. (Ontario). Dept. of Systems Design.
VIBRATIONS AND STABILITY OF MECHANICAL SYSTEMS
K. Huseyin *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 8, No. 4 Apr. 1976 p 56-66 refs (For availability see N76-26567 17-39)
CSCL 20/11

Damping in finite-degree-of-freedom mechanical systems and recent developments pertaining to such systems are reviewed. Particular emphasis is placed on explicit load-frequency relationships and stability boundaries. Mathematical models of an n-degree-of-freedom linear dynamic system are given. Systems are discussed according to the following classifications: (1) conservative (nongyroscopic), (2) gyroscopic conservative, (3) pseudo-conservative, and (4) circulatory. The effect of damping is considered separately in each case. Author

N76-26570 Loughborough Univ. of Technology (England). Dept. of Transport Technology.
WIND-EXCITED BEHAVIOUR OF STRUCTURES
D. J. Johns *In* Shock and Vibration Inform. Center Shock and Vibration Dig., Vol. 8, No. 4 Apr. 1976 p 67-75 refs (For availability see N76-26567 17-39)
CSCL 20/11

A general discussion and literature review on the subject of 'wind engineering' for buildings, bridges, and other structures (shells, cylinders) is presented. Topics discussed are: (1) static effects of wind, including static stress and buckling, and (2) the dynamic effects of wind, including dynamic response to aeroelasticity. Mathematical models of wind turbulence effects (such as damping) on shells and cylinders are treated. J.R.T.

N76-26571 British Library Lending Div., Boston Spa (England).
CALCULATION OF THE COIL PRESSURE ON THE COILER DRUM AND THE PRESSURE BETWEEN THE TURNS
Mikh. A. Benyakovskii [1975] 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), no. 6, 1975 p 83-86
(BLL-M-25236-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The coil is considered as a combination of thin-walled cylinders. For obtaining calculating formulas, use is made of the solution of the Lame problem for thin-walled cylinder. The relationship is established between the coil pressure on the coiler drum, the pressure between the turns, and the parameters of the drum and coiled strip. Author

N76-26572+ National Bureau of Standards, Washington, D.C. Center for Building Technology.
ABNORMAL LOADING ON BUILDINGS AND PROGRESSIVE COLLAPSE: AN ANNOTATED BIBLIOGRAPHY Final Building Science Series Report, 1974
E. V. Leyendecker, J. E. Breen, N. F. Somes, and M. Swatta Jan. 1976 63 p Sponsored in part by HUD Prepared in cooperation with Tex. Univ., Austin and Bechtel Corp., San Francisco
(PB-248984/7; NBS-BSS-67; LC-75-619098) Avail: NTIS HC $4.50 CSCL 13M

Information is presented on the subjects of abnormal loading and progressive collapse in an annotated listing of articles which have appeared in technical literature from 1948 through 1973. The entries have been arranged chronologically by year and alphabetically within years. Both subject and author indexes have been included. References pertaining to characteristics, frequencies, incidents, tests, design procedures, and regulations for many types of abnormal loadings are included. Among these are various types of accidental impacts, construction loads, explosions, faulty practices and extreme atmospheric loads. Heavy emphasis was placed on referencing applicable building codes and regulations. Author

N76-26573 Pittsburgh Univ., Pa.
THE NONLINEAR DYNAMIC RESPONSE OF A CABLE-STAYED BRIDGE TO VARIOUS LOADINGS Ph.D. Thesis
Engin A. Egeseli 1975 261 p
Avail: Univ. Microfilms Order No. 76-14128

A cable-stayed girder bridge is an indeterminate structure in which the girder behaves in a similar fashion to that of a continuous beam supported elastically at the points of cable connections to the girder. A method is presented for the nonlinear dynamic analysis of planar cable-stayed bridges. The method is based on step-by-step integration algorithm and work in terms of the inertia force vector and its time derivatives at the beginning and end of a step. Thus it is an implicit method and in general is solved iteratively. It uses a fifth degree polynomial for the displacements, does not involve matrix inversion when a lumped mass matrix is employed, and the nodal forces are calculated directly from the total displacements, so there is no need to store the global stiffness matrix. Dissert. Abstr.

N76-26574 California Univ., Los Angeles.
INCLUSION OF CRACK GROWTH AND FRACTURE CONSTRAINTS IN AUTOMATED DESIGN Ph.D. Thesis
Caleb Stone Davis 1976 430 p
Avail: Univ. Microfilms Order No. 76-12198

Fatigue crack growth and fracture technology are developed as constraints in automated design of structures for the first time. For crack growth and fracture, a technical level of analysis is employed. This includes the compounding of available stress-intensity factor solutions, final crack size estimation with fracture constraints from an inverted crack growth resistance curve, and an average and integrate strategy for life prediction. For design optimization, a mathematical programming approach is taken and a range of approximation concepts are employed to reduce the effort involved in the constraint calculations. In the design procedure, deletion of constraints and replacement of original constraint analyses by approximate substitutes define a sequence of approximate subproblems for design solution. The analysis effort is first reduced by an initial deletion of constraints over several analyses for subproblem definition until ignored constraints can possibly become critical. Dissert. Abstr.

N76-26575 Georgia Inst. of Tech., Atlanta.
THE INTRINSIC STRESS FIELD NEAR A CRACK TIP Ph.D. Thesis
Michael Clifton Yaksh 1975 112 p
Avail: Univ. Microfilms Order No. 76-12620

Models which could account for the intrinsic stress field of a solid due to the mutual attraction of its parts were studied. The first model considered was a linear chain of particles. The removal of a finite length from a chain with remote free ends and the subsequent deformation revealed a body force arising from two sources. The analysis of a half plane with a free surface began with the development of a mathematical model for the body force. Evaluating the body force for a half plane led to the determination of the stresses, strains, displacements and strain energy. The crack was considered to prohibit the attraction of any material that it separated. The finite-element method was employed, and a special rectangular element (representing the crack tip and the material near the crack tip) was used to determine the stresses and displacements. Dissert. Abstr.

N76-26576 Stanford Univ., Calif.
COMBINED BOUNDS ANALYSIS OF THE DEFORMATION OF PLASTIC STRUCTURES UNDER IMPACT Ph.D. Thesis
Gustav Adolph Nystrom 1976 103 p
Avail: Univ. Microfilms Order No. 76-13057

Theorems which provide upper or lower bounds on the deformation of plastic structures are discussed. It is shown how available lower bound information may be used to improve the upper bounds on displacement which are obtained without using the lower bound information. Similarly, it is shown how available upper bound information may be used to improve the lower bounds. A reciprocative bound calculation is introduced which alternates between calculating combined upper-and combined lower-bounds. For lumped mass structures, it is shown that the calculation of the best possible bounds on displacements involves the minimization of a nonlinear function subject to linear constraints on the independent variables. The algorithm for treating impulsively loaded, lumped mass, elastic-plastic or rigid-plastic models is presented along with numerical results obtained using automobile crashworthiness models. Dissert. Abstr.

N76-26577 Pennsylvania Univ., Philadelphia.
BRITTLE FRACTURE UNDER MULTIAXIAL LOADING CONDITIONS Ph.D. Thesis
Louis Paul Mirandy 1975 166 p
Avail: Univ. Microfilms Order No. 76-12312

Stress-fracture criteria are developed for brittle materials subject to multiaxial loading conditions. The criteria are based upon the stress concentrations produced by a system of flaws modelled as flat, triaxial, ellipsoidal cavities. The corresponding effects of flaw three-dimensionally, limited plastic flow, and finite flaw deformation are investigated. In order to generate the associated stress-fracture surfaces, it is necessary to evaluate the state of stress perturbed by a flat ellipsoidal cavity. This is accomplished with the aid of a solution for ellipsoidal inclusions given by Eshelby. Eshelby's solution is in rather general terms, which allow the implicit determination of the Cartesian components of stress. EXPLICIT expressions are developed which are asymptotically valid for flat ellipsoids, for the stresses everywhere on the surface of the cavity. Dissert. Abstr.

N76-26578 Illinois Inst. of Tech., Chicago.
CREEP ANALYSIS OF AXISYMMETRIC SHELLS USING A NUMERICAL INTEGRATION SCHEME Ph.D. Thesis
Freydoon Arbabi-Kanjoori 1975 113 p
Avail: Univ. Microfilms Order No. 76-13141

A numerical integration solution technique is presented for the problem of creep of axisymmetric shells having arbitrarily shaped generators subjected to arbitrary time varying loads and material properties. Using a phenomenological approach the existing creep theories are divided into two categories: equation of state and memory theory. The merits of the two approaches are discussed and compared. Some of the most commonly used laws such as strain hardening and time hardening are examined explicitly. Using a general creep law, the incremental form of the governing differential equations is derived for the creep analysis of shells of revolution. The formulation is for anisotropic layered shells with arbitrary shapes of generators and general loading conditions. Dissert. Abstr.

N76-26579# Royal Aircraft Establishment, Farnborough (England).
MATERIALS, CONSTRUCTION AND STRENGTH
M. R. LHermite Jan. 1976 36 p Transl. into ENGLISH from the French report
(RAE-Lib-Trans-1877; BR52386) Avail: NTIS HC $4.00

The principal deformations observed in materials subjected to various forces but particularly to shear is reported. As a first step in analyzing the deformations a distinction is drawn between structural materials (solid and pseudo-solid) with partial relaxation and non-structural materials (liquid and pseudo-liquid) with total relaxation; the former are characterized by rupture, the latter not. The difference between these two types of materials is characterised by their reactions to a stress cycle. An attempt is made to distinguish between these different effects without forgetting that the boundaries between them are often tenuous. Also introduced are stresses other than pure shear and this has led to a statement of the conception of rigidity and a description of a rigidimeter for concrete. Author

N76-26580*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FRACTURE ANALYSIS OF SURFACE AND THROUGH-CRACKS IN CYLINDRICAL PRESSURE VESSELS
James C. Newman, Jr. Washington 1976 43 p refs To be presented at the ASME Intern. Joint Pressure Vessels, Piping, and Petrol. Eng. Conf., Mexico City, 19-24 Sep. 1976
(NASA-TM-X-73923; Rept-2532) Avail: NTIS HC $4.00 CSCL 13M

A previously developed fracture criterion was applied to surface- and through-cracked cylindrical pressure vessels to see how well the criterion can correlate fracture data. Fracture data from the literature on surface cracks in aluminum alloy, steel, and epoxy vessels and on through cracks in aluminum alloy, titanium alloy, steel, and brass vessels were analyzed using the fracture criterion. The criterion correlated the failure stresses to within + or - 10 percent for either surface or through cracks over a wide range of crack size and vessel diameter. The fracture criterion was also found to correlate failure stresses from flat plates (center-crack or double-edge-crack tension specimens) and cylindrical pressure vessels containing through - cracks within + or - 10 percent. Author

N76-26581*# California Univ., Los Angeles.
ACCESS 1: APPROXIMATION CONCEPTS CODE FOR EFFICIENT STRUCTURAL SYNTHESIS PROGRAM DOCUMENTATION AND USER'S GUIDE
Hirokazu Miura and Lucien A. Schmit, Jr. May 1976 94 p refs
(Grant NGR-05-007-337)
(NASA-CR-144905) Avail: NTIS HC $5.00 CSCL 13M

The program documentation and user's guide for the ACCESS-1 computer program is presented. ACCESS-1 is a research oriented program which implements a collection of approximation concepts to achieve excellent efficiency in structural synthesis. The finite element method is used for structural analysis and general mathematical programming algorithms are applied in the design optimization procedure. Implementation of the computer program, preparation of input data and basic program structure are described, and three illustrative examples are given. Author

N76-26582*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VIBRATION AND INSTABILITY OF PLATE-ASSEMBLIES INCLUDING SHEAR AND ANISOTROPY (VIPASA) USER'S GUIDE, ADDENDUM
Melvin S. Anderson, Katherine W. Hennessy, and Walter L. Heard, Jr. May 1976 50 p
(NASA-TM-X-73914) Avail: NTIS HC $4.00 CSCL 13M

Extensions developed at Langley Research Center to the VIPASA computer program are described including a procedure for simple thermal stress analysis and options for graphical display of output. Input requirements for operation of the modified program are given in detail. Author

N76-26583*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A METHOD FOR MEASURING BIAXIAL STRESS IN A BODY SUBJECTED TO STRESS INDUCING LOADS Patent Application

Wayman N. Clotfelter, inventor (to NASA) Filed 28 Jun. 1976 15 p
(NASA-Case-MFS-23299-1; US-Patent-Appl-SN-700673) Avail: NTIS HC $3.50 CSCL 13M

A method for measuring stress in test articles is presented. A series of transit time differentials between the second wave echo for a longitudinal wave and the first wave echo for each of a pair of shear waves propagated through the specimen is obtained as it is subjected to a known stress load of a series of stress loads. A series of indications of the magnitudes for stress loads induced in the specimen is established, and a transit time differential is obtained between the second wave echo for a longitudinal wave and the first wave echo for each of a pair of shear waves propagated in the planes of the stress axes of the test article. The transit time differential thus is compared to the series of transit time differentials obtained for the specimen to determine the magnitude of biaxial stress in the test article.
NASA

N76-26584*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CRACK-OPENING DISPLACEMENTS IN CENTER-CRACK, COMPACT, AND CRACK-LINE WEDGE-LOADED SPECIMENS
J. C. Newman, Jr. Washington Jul. 1976 32 p refs
(NASA-TN-D-8268; L-10829) Avail: NTIS HC $4.00 CSCL 13M

The theoretical crack-opening displacements for center-crack, compact, and crack-line wedge-loaded specimens (reported in the ASTM Proposed Recommended Practice for R-Curve Determination (1974)) disagree with experimental measurements in the literature. The disagreement is a result of using approximate specimen configurations and load representation to obtain the theoretical displacements. An improved method of boundary collocation is presented which was used to obtain the theoretical displacements in these three specimen types; the actual specimen configurations and more accurate load representation were used. In the analysis of crack-opening displacements in the compact and crack-line wedge-loaded specimens, the effects of the pin-loaded holes were also included. The theoretical calculations agree with the experimental measurements reported in the literature. Also examined are accurate polynomial expressions for crack-opening displacements in both compact and crack-line wedge-loaded specimens. Author

N76-26585*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF THE AERODYNAMIC ENERGY CONCEPT TO FLUTTER SUPPRESSION AND GUST ALLEVIATION BY USE OF ACTIVE CONTROLS
E. Nissim (Technion-Israel Inst. of Technol.), A. Caspi (Israel Aircraft Ind.), and I. Lottati (Technion-Israel Inst. of Technol.) Washington Jun. 1976 93 p refs
(NASA-TN-D-8212; L-10738) Avail: NTIS HC $5.00 CSCL 01A

The effects of active controls on flutter suppression and gust alleviation of the Arava twin turboprop STOL transport and the Westwind twinjet business transport are investigated. The active control surfaces are introduced in pairs which include, in any chosen wing strip, a 20-percent chord leading-edge control and a 20-percent chord trailing-edge control. Each control surface is driven by a combined linear-rotational sensor system located on the activated strip. The control law is based on the concept of aerodynamic energy and utilizes previously optimized control law parameters based on two-dimensional aerodynamic theory. The best locations of the activated system along the span of the wing are determined for bending-moment alleviation, reduction in fuselage accelerations, and flutter suppression. The effectiveness of the activated system over a wide range of maximum control deflections is also determined. Two control laws are investigated. The first control law utilizes both rigid-body and elastic contributions of the motion. The second control law employs primarily the elastic contribution of the wing and leads to large increases in the activated control effectiveness as compared with the basic control law. The results indicate that flutter speed can be significantly increased (over 70 percent increase) and that the bending moment due to gust loading can be almost totally eliminated by a control system of about 10 to 20 percent span with reasonable control-surface rotations. Author

N76-26586*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ENGINEERING PROCEDURE FOR CALCULATING COMPRESSIVE STRENGTH OF ISOGRID CYLINDRICAL SHELLS WITH BUCKLED SKIN
Walter L. Heard, Jr., Melvin S. Anderson, and Paul Slysh (General Dynamics/Convair, San Diego, Calif.) Jun. 1976 37 p refs
(NASA-TN-D-8239; L-10860) Avail: NTIS HC $4.00 CSCL 13M

An engineering procedure is presented for calculating the compressive buckling strength of isogrid cylinders using shell of revolution techniques and accounting for loading beyond the material proportional limit and/or local buckling of the skin prior to general buckling. A general nondimensional chart is presented which can be used in conjunction with formulas based on simple deformation plasticity theory to calculate postbuckling stiffnesses of the skin. The stiffening grid system is treated as an equivalent isotropic grid layer. Stiffnesses are determined for this grid layer, when loaded beyond the proportional limit, by the same plasticity theory used for the skin and a nonlinear stress-strain curve constructed from simple isogrid-handbook formulas and standard-reference-manual stress-strain curves for the material involved. Comparison of prebuckling strains and buckling results obtained by this procedure with data from a large isogrid-cylinder test is excellent with the calculated buckling load no more than 4 percent greater than the test value. Author

N76-26587*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PREDICTING FAILURE OF SPECIMENS WITH EITHER SURFACE CRACKS OR CORNER CRACKS AT HOLES
J. C. Newman, Jr. Washington Jun. 1976 39 p refs
(NASA-TN-D-8244; L-10203) Avail: NTIS HC $4.00 CSCL 13M

A previously developed fracture criterion was applied to fracture data for surface-cracked specimens subjected to remote tensile loading and for specimens with a corner crack (or cracks) emanating from a circular hole subjected to either remote tensile loading or pin loading in the hole. The failure stresses calculated from this criterion were consistent with experimental failure stresses for both surface and corner cracks for a wide range of crack shapes and crack sizes in specimens of aluminum alloy, titanium alloy, and steel. Empirical equations for the elastic stress-intensity factors for a surface crack and for a corner crack (or cracks) emanating from a circular hole in a finite-thickness and finite-width specimen were also developed. Author

N76-26588# Blume (John A.) and Associates Research Div., San Francisco, Calif.
VIBRATION TESTS OF A 4-STORY REINFORCED CONCRETE TEST STRUCTURE
C. K. Chen, R. M. Czarnecki, and R. E. Scholl Jan. 1976 108 p refs
(Contract AT(26-1)-99)
(JAB-99-119) Avail: NTIS HC $6.50

The results of a series of vibration tests conducted in 1974 to determine the dynamic response characteristics of a 4-story concrete test structure located at the Nevada Test Site are presented. The testing of this structure can be generally categorized as follows: nondestructive tests consisting of frequency sweep tests and frequency dwell tests, exciting four translational modes of vibration in the north-south (longitudinal) direction and three modes in the east-west (transverse) direction at low and intermediate force levels; a destructive test consisting of a frequency dwell test, exciting the lowest north-south translational mode at intermediate and high force levels, during which the structure exhibited inelastic response and suffered major structural damage; and a series of post-destructive tests using force levels similar to the nondestructive tests, conducted to investigate the response of the structure after it had experienced structural damage. Author (NSA)

N76-26589# European Space Agency, Paris (France).
THE MIXED VARIATIONAL PRINCIPLE IN ELASTICITY AND ITS APPLICATION TO THE CALCULATION OF PLATE

BENDING
Bernard Thomas Apr. 1976 114 p refs Transl. into ENGLISH of 'Principe Variationnel Mixte en Elasticite et Appl. au Calcul d'une Plaque en Flexion', ONERA, Paris Report ONERA-NT-233, 1974
(ESA-TT-275; ONERA-NT-233) Avail: NTIS HC $5.50

The application of the Reissner and Fraeijs de Veubecke principle was investigated and experimentally verified. The principle is re-established from the weak formulation of the mixed problem involving displacements and stresses. The solution of the elastic problem is simultaneously the unique stationary point and the unique saddle-point of the functional. Various extensions of this principle are proposed. The approximation of the principle by the finite element method is given, and the bending of a plate is treated as an example. The finite element used is adapted to the calculation of thick plates and ensures the continuity of displacements and stresses throughout the plate. Results are compared with those of the displacement method and those of experiment. The stresses on the surface of the plate were measured by means of two experiments which require a photoelastic coating to be bonded to the plate: a photoelastic experiment giving the difference of the principal stresses and their orientation; and an experiment using holographic interferometry, which gives the sum of the principal stresses. Author (ESA)

N76-26590# European Space Agency, Paris (France).
LINEAR BUCKLING OF STRUCTURES. APPLICATION TO ANALYSIS OF PLATES BY FINITE ELEMENTS
Germaine Nefussi Apr. 1976 89 p refs Transl. into ENGLISH of 'Flambage Lineaire des Struct. Appl. au Calcul de Plaques par Elements Finis', ONERA, Paris Report ONERA-NT-1975-6, 1975
(ESA-TT-285; ONERA-NT-1975-6) Avail: NTIS HC $5.00

For the purpose of linking some theoretical investigations dealing with stability with usual buckling analysis, within the framework of linear elasticity, two methods were used to re-establish the general equations governing the instability of an equilibrium position. In both methods particular attention was given to the assumptions, often used in analytical or numerical calculations, leading to the classical buckling equations. The case of the linear buckling of a trapezoidal plate, subjected to a relatively complex inplane loading, by a finite element method was also considered. Author (ESA)

N76-26591 Shock and Vibration Information Center (Defense), Washington, D.C.
THE SHOCK AND VIBRATION DIGEST, VOLUME 8, NUMBER 1, JANUARY 1976
Jan. 1976 109 p refs
(AD-A022495) Avail: NTIS MF $2.25; HC available from Shock and Vibration Information Center, Naval Research Lab., Code 8404, Washington, D. C. 20375. Annual subscription $40.00
CSCL 20/11

Standards and specifications are reported for shock and vibration testing of mechanical structures. For individual titles, see N76-26592 through N76-26594.

N76-26592 Vibration Inst., Downers Grove, Ill.
PROGRESS IN SHOCK AND VIBRATION STANDARDS DURING 1975
R. L. Eshleman and H. C. Pusey (Shock and Vibration Inform. Center) *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 8, No. 1, Jan. 1976 Jan. 1976 p 5-23 (For availability see N76-26591 17-39)
CSCL 20/11

International standardization efforts for sinusoidal and random vibration testing of electrical, electromechanical and electronic equipment are outlined. New standards are being developed for seismic vibration and acoustic phenomena. Some abstracts from the current literature are included that cover test analysis and design methods for structural forms as well as for human factors engineering aspects. G.G.

N76-26593 State Univ. of New York, Buffalo. Dept. of Mechanical Engineering.
OPTIMIZATION TECHNIQUES FOR SHOCK AND VIBRATION ISOLATOR DEVELOPMENT
R. Mayne *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 8, No. 1, Jan. 1976 Jan. 1976 p 87-94 refs (For availability see N76-26591 17-39)
CSCL 20/11

Optimization strategies for shock and vibration isolation test applications include nonlinear programming techniques, time domain procedures for isolator design, and application of optimal control concepts to the optimum design of systems subjected to random excitation. G.G.

N76-26594 Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
BOLOTIN'S DYNAMIC EDGE EFFECT METHOD
I. Elishakoff *In* Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 8, No. 1, Jan. 1976 Jan. 1976 p 95-104 refs (For availability see N76-26591 17-39)
CSCL 20/11

An asymptotic method utilizing the edge effect concept is used to determine eigenvalue density responses in vibration analyses on elastic bodies. Stochastic edge effects are also applied to interpret spectral and correlational characteristics obtained by summing system modes and to thermoelastic stress analyses on shells in turbulent flow. G.G.

N76-26595# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
INTERLAMINAR STRESSES IN LAMINATED CYLINDRICAL SHELLS OF COMPOSITE MATERIALS M.S. Thesis - Interim Report
Terence L. Waltz and Jack R. Vinson Jan. 1975 111 p refs (Grant AF-AFOSR-2739-74; AF Proj. 9782)
(AD-A019576; MAE-TR-186; AFOSR-75-1629TR) Avail: NTIS
CSCL 20/11

Methods of analysis are developed for a laminated circular cylindrical shell composed of generally orthotropic materials subjected to arbitrary axially symmetric mechanical loadings. Elastic shell theory including transverse shear deformation is used. By treating each lamina individually, and imposing stress and displacement boundary conditions at the interfaces between laminae, the governing equations for the individual laminae are combined, yielding the interlaminar shear and normal stresses as explicit dependent variables. The results are presented in the form of a parametric study for a generally orthotropic circular cylindrical shell comprised of two and three laminae, subjected to a uniform pressure with both clamped and simply supported boundary conditions. Variables in the parametric study include laminate geometry, fiber orientation, stacking sequence and material properties. A computer program has been formulated to expedite calculations of the analytical solution. Author (GRA)

N76-26596# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
THE EFFECT OF TRANSVERSE SHEAR DEFORMATION ON THE ELASTIC STABILITY OF PLATES OF COMPOSITE MATERIALS Interim Report
Jack R. Vinson and Alton P. Smith, Jr. 1975 82 p refs (Grant AF-AFOSR-2739-74)
(AD-A019566; MAE-TR-180; AFOSR-75-1628TR) Avail: NTIS
CSCL 20/11

Methods of analysis are developed for determining the critical inplane buckling loads for plates of composite materials with a wide variety of boundary conditions. Although the expressions developed are restricted to specially orthotropic construction of one lamina, their use is more general, and can be used for laminated specially orthotropic plates that are symmetric with respect to the plate midsurface (i.e. no bending-stretching coupling). It is seen that the effects of transverse shear deformation can be significant, not only in altering the magnitude of the buckling loads but even in altering the wave number. Author (GRA)

N76-26597# Aerospace Corp., El Segundo, Calif.
OBSERVATIONS ON APPROXIMATE AND EXACT TREATMENTS OF FRACTURE STATISTICS FOR POLYAXIAL STRESS STATES Final Report
Samuel B. Batdorf 4 Dec. 1975 17 p refs (Contract F04701-75-C-0076)
(AD-A019572; TR-0076(9990)-2; SAMSO-TR-75-289) Avail: NTIS CSCL 20/11

An approximate technique sometimes used for estimating the probability of failure of brittle materials under polyaxial loading conditions is to assume that the effect of each principal stress is independent of the presence of the others. It is shown that this assumption is generally unconservative, and that the errors can be large. An exact treatment is given in terms of Weibull theory for materials that obey Weibull's two-parameter formulation, and a simple conservative approximation is suggested for such materials. Author (GRA)

N76-26598# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
THE RICCATI TRANSFER MATRIX METHOD
Garnet C. Horner and Walter D. Pilkey Jan. 1975 32 p refs (Contract N00014-75-C-0374; NR Proj. 122-303)
(AD-A019848; ESS-3532-101-76) Avail: NTIS CSCL 20/11

The Riccati transfer matrix method is a new technique for analyzing structural members. This new technique makes use of an existing large catalog of transfer matrices for various structural members. The numerical instability encountered when calculating high resonant frequencies, static response of a flexible member on a stiff foundation, or the response of a long member by the transfer matrix method is eliminated by the Riccati transfer matrix method. The computational time and storage requirements of the Riccati Transfer matrix method are about half the values for the transfer matrix method. GRA

N76-26599# GIA Consultants, Inc., Monroeville, Pa.
LONGITUDINAL UNBALANCED LOADS ON TRANSMISSION LINE STRUCTURES (A STATE-OF-THE-ART REVIEW) Interim Report
John D. Mozer Nov. 1975 72 p refs Sponsored by Elec. Power Res. Inst., Palo Alto, Calif.
(PB-248316/2; EPRI-RP561) Avail: NTIS HC $4.50 CSCL 13M

The state of the art of design for longitudinal unbalanced loads on transmission structures is reviewed. The results constitute the first phase of a program for the development of design aids for the rapid determination of unbalanced longitudinal forces on rigid and flexible transmission structures due to unbalanced ice, broken conductor or OHGW, or any other abrupt discontinuity in the longitudinal conductor tensions. GRA

N76-26600# National Bureau of Standards, Washington, D.C. Center for Building Technology.
DEFLECTION PERFORMANCE CRITERIA FOR FLOORS Final Report
Robert A. Crist and James R. Shaver Dec. 1975 30 p refs Sponsored in part by Dept. of Housing and Urban Develop., Washington, D. C.
(PB-249134/8; NBSIR-75-906) Avail: NTIS HC $4.00 CSCL 13M

Serviceability performance criteria for floor systems are discussed in terms of their static and dynamic components. Development of traditional static stiffness criteria is given along with a review of their strengths and weaknesses. Criteria for serviceable floors are presented from a vibration viewpoint and the derivation of an improved criterion is given. A new approach for future vibration criteria is described. GRA

N76-26601# National Bureau of Standards, Washington, D.C.
CORRECTION OF FLOOR VIBRATION TO HUMAN RESPONSE Final Report
James R. Shaver Dec. 1975 33 p refs
(PB-249094/4; NBSIR-75-951) Avail: NTIS HC $4.00 CSCL 13M

A new approach to the problem of perceptible floor vibrations is presented predicated on the realization that human activity and human response to this activity are random variables. Techniques for data reduction are discussed and a detailed description of one approach is given along with the associated computer program. Data from floor vibrations are compared with current criteria for human response to vibration. GRA

N76-26602+ National Bureau of Standards, Washington, D.C.
AN OVERVIEW OF FLOOR SLIP-RESISTANCE RESEARCH WITH ANNOTATED BIBLIOGRAPHY
Robert J. Brungraber Jan. 1976 116 p
(PB-248985/4; NBS-TN-895) Avail: NTIS HC $5.50 CSCL 13M

Slips and falls in the home as well as in public buildings have reached serious proportions (8,000,000 accidents per year in the home, resulting in 9,600 deaths and 1,600,000 disabling injuries). Based on studies of kinesiology and anthropometry, the coefficient of friction between foot surfaces and floor surfaces is found to be a significant parameter controlling slips and falls. A review of the general study of friction and a critical appraisal of methods for determining the coefficient of friction on slip-resistance of floors leads to a guide for selection of slip-resistance criteria. The legal aspects of the problem and the present status of slip-resistance specifications are discussed. GRA

N76-26603# National Bureau of Standards, Washington, D.C.
THE AVOIDANCE OF PROGRESSIVE COLLAPSE: REGULATORY APPROACHES TO THE PROBLEM Final Report
Eric F. P. Burnett Nov. 1975 180 p refs Sponsored in part by Dept. of Housing and Urban Develop., Washington, D. C.
(PB-248781/7; NBS-GCR-75-48) Avail: NTIS HC $7.50 CSCL 13M

The progressive-collapse related provisions of the building regulations of the United Kingdom, Sweden, Denmark, West Germany, Netherlands, Canada, France and Eastern Europe are studied in detail. The various regulations are discussed individually for their content, background and interpretation. Both building regulatory and design problems associated with the implementation of progressive collapse design requirements are discussed. A comparative evaluation is then made of the regulations discussed in the report. GRA

N76-26604# California Univ., Berkeley. Earthquake Engineering Research Center.
STATE-OF-THE-ART IN SEISMIC SHEAR STRENGTH OF MASONRY: AN EVALUATION AND REVIEW
Ronald L. Mayes and Ray W. Clough Oct. 1975 138 p refs (Grant NSF AEN73-07732-A02)
(PB-249040/7; EERC-75-21) Avail: NTIS HC $6.00 CSCL 13M

The state-of-the-art report presented attempts to review and evaluate all the relevant research performed on the shear strength of masonry subassemblages. The report is divided into thirteen sections. Seven sections examine the effects of parameters such as grout, mortar, type of bond, reinforcement, bearing load and rate of loading on the shear strength of subassemblages while the other six evaluate the characteristics of the modes of failure and inelastic behavior of the subassemblages. GRA

N76-26605# California Univ., Berkeley. Div. of Structural Engineering and Structural Mechanics.
A NETWORK-TOPOLOGICAL APPROACH TO THE FINITE ELEMENT ANALYSIS OF PROGRESSIVE CRACK GROWTH IN CONCRETE MEMBERS
Jun. 1975 298 p refs
(PB-248845/0; UCSESM-75-6) Avail: NTIS HC $9.25 CSCL 13M

A computer technique was studied, which is capable of simulating crack growth by automatically generating crack-lines in the finite element model. A network-topological approach is proposed to facilitate such an analysis. A system concept is adopted in which the entire structure is treated as a structural network and the various structural elements are treated as the network components. Cracking in the concrete members is then reviewed as merely a change in the structural network topology. Graph theoretic matrices are used in describing and recording the topology of the structural network as cracking progresses. GRA

N76-26606# Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.
SKID-RESISTANT CHARACTERISTICS OF EXISTING PAVEMENTS IN ILLINOIS Interim Report, Jul. 1968 - Jul. 1973
Phillip G. Dierstein and Donald R. Schwartz Oct. 1975 80 p refs
(PB-249459/9; Phys-Res-56) Avail: NTIS HC $5.00 CSCL 13B

Over 8,300 skid tests were made between 1969 and 1971 at 404 sites on existing Interstate, primary, and county highways in Illinois. They indicate that textured portland cement concrete surfaces on two-land highways can provide skid numbers (SN) above 35 throughout most of their 20-year design life as long as studded tire wear is negligible, but most multilane highways will need rejuvenating by grooving or by adding a friction course some time during their service life. Bituminous concrete surfaces generally have a lower value and a wider range of SN than PCC pavements. In northern and central Illinois, most two-lane bituminous concrete surfaces, which usually contain dolomite or crushed gravel, can provide an SN above 35 throughout most of their 15-year design life, while similar surfaces containing soft limestone in southern Illinois will need a hard skid-resistant aggregate blended with limestone to maintain an SN above 35. Also, multi-lane highways resurfaced with bituminous concrete will need a hard skid-resistant aggregate blended with or substituted for limestone to keep an SN above 35. Specific recommendations are included for improving skid resistance. GRA

N76-26607# Florida Univ., Eglin AFB. Graduate Engineering Center.
STUDY OF DYNAMIC RESPONSE OF SHELL STRUCTURES TO BLAST LOADS Final Report, 19 Sep. 1974 - 30 Jun. 1975
C. A. Ross and J. E. Milton Sep. 1975 56 p refs
(Contract F08635-75-C-0022; AF Proj. 2549)
(AD-A021755; AFATL-TR-75-117) Avail: NTIS CSCL 13/13

This report presents an effort to model the response of cylindrical shells to fuel air explosions and mild high energy explosion. Two different methods were used in the analysis. The first method assumes small strain to derive the equation of motion using a force balance method. The second method was based on finite strain coupled with an energy method using a Lagrangian formulation for the equations of motion. Several equations of motion are derived for the finite strain case using several mode shapes for both full shell stiffness and half shell stiffness. Spatial integration was performed by hand and the resulting equations of motions were solved numerically using a CDC 3600 MIMIC Source Language Program. Author (GRA)

42 GEOSCIENCES (GENERAL)

N76-26608*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A PRIMER OF BASALTIC AND STRATIFORM IGNEOUS ROCKS AND THEIR EXTRATERRESTRIAL ANALOGS
T. E. Bunch Apr. 1976 78 p refs
(NASA-TM-X-73114; A-6495) Avail: NTIS HC $5.00 CSCL 08G

Textural interpretation and mineralogy of terrestrial basalts and cumulate rocks, and similarities with extraterrestrial analogs are presented. Author

N76-26609# Northern Tier Regional Planning and Development Commission, Towanda, Pa.
FLOOD MANAGEMENT STUDY Final Report
Oct. 1974 134 p refs
(Grants HUD-CPA-1047; ARC-73-82/PA-2355)
(PB-249456/5; NTRPDC-52-0090) Avail: NTIS HC $6.00 CSCL 13B

Many potential approaches to land use and flood management within the Northern Tier Flood Management Study Area have been presented within this study. These approaches are reviewed in relation to two basic questions: upon what type of techniques should flood management activities within the study area be based; and what specific and non-structural techniques should be given a high priority for implementation. GRA

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N76-26610 Florida Univ., Gainesville.
A STUDY AND EVALUATION OF SALTWATER INTRUSION IN THE FLORIDAN AQUIFER BY MEANS OF A HELE-SHAW MODEL Ph.D. Thesis
Andrew Joseph Evans, Jr. 1975 228 p
Avail: Univ. Microfilms Order No. 76-12073

A Hele-Shaw model was built for the coastline zone of the middle gulf area of Florida, and all pertinent geological and hydrological features of the area were included. Steady state characteristics of the aquifer system were considered. In particular, the long-term effects due to pumping and artificial recharge were examined. Dissert. Abstr.

N76-26611 Texas A&M Univ., College Station.
EVALUATION OF LANDSAT MULTISPECTRAL SCANNER DATA FOR MAPPING VEGETATED LANDSCAPES Ph.D. Thesis
David Richard Thompson 1975 168 p
Avail: Univ. Microfilms Order No. 76-12699

The LANDSAT multispectral scanner data were selected to represent periods of adequate soil water, soil water deficit, and beginning of soil water recharge in Brazos County, Texas to evaluate LANDSAT multispectral scanner data for mapping vegetated soil landscapes. Six test sites were evaluated using LARSYS computer programs developed by the Laboratory for Application of Remote Sensing, Purdue University. Open grassland soils were best separated at a period when soil moisture was being replenished after a deficit period. Woodland soils were separated by LANDSAT data only when adequate moisture was available in late spring. Separation was not possible during a period of soil water deficit. The 0.6-0.7 micrometers spectral band of LANDSAT was most significant in separating grassland vegetation while the 0.7-0.8 micrometers spectral band was the most significant on wooded vegetation. Dissert. Abstr.

N76-26612 Colorado State Univ., Fort Collins.
SPECTRAL ESTIMATION OF GRASS CANOPY VEGETATIONAL STATUS Ph.D. Thesis
Compton James Tucker, III 1975 121 p
Avail: Univ. Microfilms Order No. 76-13669

The relationships between spectroreflectance and the sampled plot variables (total wet biomass, total dry biomass, leaf water, dry green biomass, dry brown biomass, and chlorophyll) of a blue grama grass canopy were evaluated as a function of wavelength for two sampling periods, one early in the growing season and one late in the growing season. The sensitivities between canopy spectroradiance or spectroreflectance and the sampled plot variables have been in turn related to the absorption spectra of the plant pigments in the visible region of the spectrum and the enhancement of spectroradiance or spectroreflectance occurring in the photographic infrared region. The number of total wet biomass classes or levels that could be spectrally discriminated late in the growing season (September) were investigated using analysis of variance methods. Dissert. Abstr.

N76-26613*+ National Aeronautics and Space Administration, Washington, D.C.
EARTH RESOURCES: A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 8, APRIL 1976
Apr. 1976 101 p
(NASA-SP-7041(08)) Avail: NTIS HC $5.50 CSCL 05B

This bibliography lists 351 reports, articles, and other documents introduced into the NASA scientific and technical information system between October 1975 and December 1975. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, hydrology and water management, data

processing and distribution system, instrumentation and sensors, and economic analysis. Author

N76-26614*# Junta Nacional de Planification, Quito (Ecuador).
FORESTRY, GEOLOGY AND HYDROLOGICAL INVESTIGATIONS FROM ERTS-1 IMAGERY IN TWO AREAS OF ECUADOR, SOUTH AMERICA Final Report, Jan. - Nov. 1973
Nestor Vega Moreno, Principal Investigator Nov. 1973 41 p Sponsored by NASA and Natl. Planning Council, Ecuador ERTS
(E76-10371; NASA-CR-147964) Avail: NTIS HC $4.00 CSCL 08F

The author has identified the following significant results. In the Oriente area, well-drained forests containing commercially valuable hardwoods can be recognized confidently and delineated quickly on the ERTS imagery. In the tropical rainforest, ERTS can provide an abundance of inferential information about large scale geologic structures. ERTS imagery is better than normal aerial photography for recognizing linears. The imagery is particularly useful for updating maps of the distributary system of the Guagas River Basin and of any other river with a similarly rapid changing channel pattern.

N76-26615*# International Inst. for Aerial Survey and Earth Sciences, Enschede (Netherlands).
THE INTERPRETATION OF ERTS-1 IMAGERY FOR SOIL SURVEY OF THE MERIDA REGION, SPAIN Final Report, May 1973 - Jun. 1974
F. W. Hilwig, D. Goosen, Principal Investigators, and D. Katsieris Sep. 1975 29 p refs Sponsored by NASA and Netherlands Geophysical Space Res. Commission ERTS
(E76-10384; NASA-CR-148151; SR-0569/4) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. Major landforms and some subdivisions could be easily recognized. Water bodies, river courses, extensive areas of miocene clays, and more recent coarse textured deposits could be delineated and existing soil maps at scales up to 1:100,000 could be updated.

N76-26616*# Geological Survey, Reston, Va.
PHOTOMAPPING OF THE UNITED STATES
Joseph T. Pilonero, Principal Investigator May 1976 14 p refs Sponsored by NASA Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 EREP
(E76-10385; NASA-CR-148165) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-26617*# Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
LANDSAT APPLICATION OF REMOTE SENSING TO SHORELINE-FORM ANALYSIS Quarterly Report, 2 Mar. - 2 Jun. 1976
Robert Dolan, Bruce P. Hayden, and Jeffrey Heywood, Principal Investigators 18 Jun. 1976 31 p ref ERTS
(Contract NAS5-20999)
(E76-10386; NASA-CR-148166) Avail: NTIS HC $4.00 CSCL 08C

The author has identified the following significant results. Data for Assateague Island and Ocracoke Island show significantly high correlations between coastal orientation and erosion. However, South Hatteras has low correlations, and North Hatteras has low negative correlations. Because all four areas are essentially in the same mid-Atlantic climatic regime, process/response relationships should be similar. Correlations for the four areas may differ considerably because of inadequate assumptions; the key is the mean orientation of the specific coastline being studied. There appears to be an orientation window surrounding due northeast (135 deg north of south) in which this hypothesis holds.

N76-26618*# Arizona Univ., Tucson. School of Renewable Natural Resources.
USE OF EARTH RESOURCES TECHNOLOGICAL SATELLITE (ERTS) DATA IN A NATURAL RESOURCE INVENTORY Final Report, Aug. 1972 - Sep. 1974
Edwin L. Smith, Phil R. Ogden, and Ernest B. Fish, Principal Investigators Jul. 1975 101 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21820)
(E76-10388; NASA-CR-148168) Avail: NTIS HC $5.50 CSCL 05B

There are no author-identified significant results in this report.

N76-26619*# Central Treaty Organization, Ankara (Turkey).
GEOLOGICAL SURVEY OF IRAN Progress Report
Eski B. M. M. Binasi, Principal Investigator [1975] 9 p Sponsored by NASA ERTS
(E76-10391; NASA-CR-148178; PR-1) Avail: NTIS HC $3.50 CSCL 08G

There are no author-identified significant results in this report.

N76-26620*# Central Treaty Organization, Ankara (Turkey).
REGIONAL INVESTIGATION OF TECTONIC AND IGNEOUS GEOLOGY IN IRAN, PAKISTAN AND TURKEY Quarterly Report, 1 Dec. 1975 - 29 Feb. 1976
Eski B. M. M. Binasi, Principal Investigator 10 May 1976 10 p refs Sponsored by NASA ERTS
(E76-10392; NASA-CR-148179; QR-2) Avail: NTIS HC $3.50 CSCL 08G

The author has identified the following significant results. It appears that the information gained from the imageries would result in revision of the existing tectonic maps of the region.

N76-26621*# California Univ., Berkeley. Space Sciences Lab.
AN INVENTORY OF IRRIGATED LANDS WITHIN THE STATE OF CALIFORNIA BASED ON LANDSAT AND SUPPORTING AIRCRAFT DATA Quarterly Progress Report, 25 Jan. - 25 Apr. 1976
Robert N. Colwell, Principal Investigator, Sharon Wall, and Dennis Noren 25 Apr. 1976 17 p ref ERTS
(Contract NAS5-20969)
(E76-10393; NASA-CR-148180; SSL-Ser-17-Issue-27) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-26622*# Alaska Univ., Fairbanks. Alaska Cooperative Wildlife Research Unit.
USE OF LANDSAT IMAGERY FOR WILDLIFE HABITAT MAPPING IN NORTHEAST AND EASTCENTRAL ALASKA Progress Report
Peter C. Lent, Principal Investigator 6 May 1976 28 p refs ERTS
(Contract NAS5-20915)
(E76-10394; NASA-CR-148181; PR-4) Avail: NTIS HC $4.00 CSCL 08B

The author has identified the following significant results. There is strong indication that spatially rare feature classes may be missed in clustering classifications based on 2% random sampling. Therefore, it seems advisable to augment random sampling for cluster analysis with directed sampling of any spatially rare features which are relevant to the analysis.

N76-26623*# National Oceanic and Atmospheric Administration, Rockville, Md. Office of Aeronautical Charting and Cartography.
ERTS IMAGERY AS DATA SOURCE FOR UPDATING AERONAUTICAL CHARTS Interim Report, period ending Mar. 1976
Joe F. Wilson, Principal Investigator Apr. 1976 27 p Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(NASA Order S-53965-A)
(E76-10395; NASA-CR-148182) Avail: NTIS HC $4.00 CSCL 08B

There are no author-identified significant results in this report.

N76-26624*# Army Engineer District, San Francisco, Calif.
CALIFORNIA COAST NEARSHORE PROCESSES STUDY USING ERTS-B DATA Progress Report, 1 Mar. - 31 May 1976
Douglas M. Pirie and David D. Steller, Principal Investigators (ESCA-Tech Corp., Long Beach, Calif.) 25 Jun. 1976 3 p ERTS
(NASA Order S-54062-A)
(E76-10396; NASA-CR-148183) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-26625*# Milan Univ. (Italy).
GEOMORPHIC AND LANDFORM SURVEY OF NORTHERN APPENNINI Quarterly Report
Carlo M. Marino, Principal Investigator 3 Jun. 1976 4 p Sponsored by NASA ERTS
(E76-10397; NASA-CR-148184; QR-3) Avail: NTIS HC $3.50 CSCL 08B

There are no author-identified significant results in this report.

N76-26626*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION AND ENFORCEMENT OF THE PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT Progress Report, 19 Mar. - 19 Jun. 1976
Orville R. Russell, Principal Investigator 19 Jun. 1976 5 p ERTS
(Contract NAS5-21998)
(E76-10398; NASA-CR-148185; C-1037-2-5; Rept-21570-2-5) Avail: NTIS HC $3.50 CSCL 08I

There are no author-identified significant results in this report.

N76-26627*# Environmental Research Inst. of Michigan, Ann Arbor.
WHEAT PRODUCTIVITY ESTIMATES USING LANDSAT DATA Progress Report, 16 Feb. - 15 May 1976
Richard F. Nalepka, John Colwell, Principal Investigators, and Daniel P. Rice 15 May 1976 6 p ERTS
(Contract NAS5-22389)
(E76-10399; NASA-CR-148186; ERIM-114800-16-LpPR-4) Avail: NTIS HC $3.50 CSCL 02C

There are no author-identified significant results in this report.

N76-26628*# Missouri Univ., Rolla.
STRUCTURAL LINEAMENTS AND MINERALIZATION IN SOUTHEAST MISSOURI Progress Report
Geza Kisvarsanyi and Eva B. Kisvarsanyi, Principal Investigators (Geological Survey, Rolla, Mo.) 7 Jun. 1976 13 p refs ERTS
(Contract NAS5-20937)
(E76-10400; NASA-CR-148187) Avail: NTIS HC $3.50 CSCL 05B

There are no author-identified significant results in this report.

N76-26629*# California Univ., Berkeley. Space Science Lab.
ERTS-1 DATA AS AN AID TO WILDLAND RESOURCE MANAGEMENT IN NORTHERN CALIFORNIA Final Report, 1 Jul. 1973 - 31 Dec. 1974
Robert N. Colwell and James D. Nichols, Principal Investigators 31 Dec. 1974 487 p refs Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21827)
(E76-10401; NASA-CR-148188; SSL-Ser-16-Issue-62) Avail: NTIS HC $12.50 CSCL 05A

The author has identified the following significant results. In the Feather River watershed region, detection of wildland resource features and conditions was done acceptably well on single-bank, single-date ERTS-1 imagery. A quasi-operational study was performed and demonstrated that ERTS-1 imagery is ideal for making vegetation/terrain type maps using manual interpretation techniques. Two quasi-operational studies demonstrated that timer inventories could be made using multistage sampling. A number of Chi square analyses of Northern California coast were performed; it was concluded that the boundaries delineated on the ERTS-1 imagery were legitimate for broad vegetation-type categories.

N76-26630*# Aeronutronic Ford Corp., Houston, Tex.
EARTH RESOURCES INTERACTIVE PROCESSING SYSTEM REQUIREMENTS
C. W. Abbitt, Principal Investigator Nov. 1975 404 p refs EREP
(Contract NAS9-1261)
(E76-10402; NASA-CR-147418; SISO-TR514; JSC-10152) Avail: NTIS HC $11.00 CSCL 05B

There are no author-identified significant results in this report.

N76-26631*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NASA EARTH RESOURCES SURVEY SYMPOSIUM. VOLUME 2-A: SPECIAL SESSION PRESENTATIONS. PLENARY SUMMARIES
Jun. 1975 163 p refs Symp. held at Houston, Texas, 9-12 Jun. 1975 Original contains color illustrations
(NASA-TM-X-58168-Vol-2A; JSC-09930-Vol-2A) Avail: NTIS HC $3.50 CSCL 05B NAS1.15:

Practical application of earth resources survey data is considered. The utilization and results of data from NASA programs involving LANDSAT, the Skylab Earth Resources Experiment Package, and aircraft, as well as other data acquisition programs are included. User services and requirements and applications in land use, agriculture, coastal zone management, and geology are among the topics covered. For Vol. 1A, see N76-17469. For individual titles, see N76-26632 through N76-26645.

N76-26632* National Aeronautics and Space Administration, Washington, D.C.
REMOTE SENSING AND APPLICATIONS
William Stoney *In its* NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 7-9 (For availability see N76-26631 17-43)
CSCL 05B

A brief review of application of remote sensing technology is given. The effectiveness of the multispectral band scanner, color analysis of imagery, and resolution are among the factor's discussed. The users' need for repetitive data, rapid data delivery, and developing digital data techniques are also considered. J.M.S.

N76-26633* National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
ALL YOU EVER WANTED TO KNOW ABOUT REMOTE SENSING
D. Wayne Mooneyhan *In its* NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 11-28 (For availability see N76-26631 17-43)
CSCL 05B

A brief review of remote sensing state-of-the-art is presented. Emphasis is placed on an understanding of remote sensing terminology. Passive and active sensors and sensor platforms from the spacecraft program to the ground truth program are described. J.M.S.

N76-26634* Department of Health, Education, and Welfare, Washington, D.C.
APPLICATIONS OF EARTH RESOURCES TECHNOLOGY TO HUMAN NEEDS
Caspar Weinberger *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 29-32 (For availability see N76-26631 17-43)
CSCL 05K

The application of remote sensing technology in the fields of health and education is examined. The technology and accomplishments of ATS 6 and the development of a nationwide

telecommunications system to meet the varied needs of the health and education communities are among the topics discussed. The economic and social aspects of utilizing and benefiting from remote sensing technology are stressed. J.M.S.

N76-26635* Geological Survey, Washington, D.C.
DEPARTMENT OF THE INTERIOR PROGRAM
James R. Balsley *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 33-36 (For availability see N76-26631 17-43)
CSCL 05A

The remote sensing activities of the Department of Interior are summarized. The use of satellite imagery in land and water management is described. Specific topics discussed include: land use mapping, exploration and discovery of metal, oil, and gas deposits, location of geological faults, and repetitive monitoring of dynamic environmental phenomena related to water resources. J.M.S.

N76-26636* Corps of Engineers, Washington, D.C.
US ARMY CORPS OF ENGINEERS PROGRAM
John Jarman and K. E. McIntyre *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 37-41 (For availability see N76-26631 17-43)
CSCL 05B

The application of satellite remote sensing technology in hydrologic studies and regulatory programs of the U.S. Army Corps of Engineers is discussed. Site selection, location of construction material, environment impact assessment, analysis of hydrologic systems, reservoir system analysis, water quality, quantity and quality of runoff from urban areas, river hydraulics, and sediment movement are among the applications described. Emphasis is placed on introducing automatic classification of multispectral data into modeling techniques used in hydrologic studies. J.M.S.

N76-26637* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE)., PART 1: THE USE OF LANDSAT DATA IN LACIE
R. B. MacDonald, F. G. Hall, and R. B. Erb *In its* NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 43-62 refs (For availability see N76-26631 17-43)
CSCL 02C

The major factors which influenced the large area crop inventory experiment design, the technical approach being pursued, the detail of the implementation of this approach, and initial results of the experiment are described. Author

N76-26638* National Oceanic and Atmospheric Administration, Houston, Tex.
THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PART 2: YIELD ESTIMATES FROM METEOROLOGICAL INFORMATION
Paul J. Waite *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 63-65 refs (For availability see N76-26631 17-43)
CSCL 02C

Crop-weather models developed for wheat from an assembled base of approximately 45 years of climatic records and historic wheat yield and production data at the stratum level are described. Utilization of meteorological data acquired by the NOAA satellites is discussed. J.M.S.

N76-26639* Department of Agriculture, Houston, Tex.
THE LARGE AREA CROP INVENTORY EXPERIMENT (LACIE). PART 3: A SYSTEMATIC APPROACH TO THE PRACTICAL APPLICATION OF REMOTE-SENSING TECHNOLOGY
Jimmy D. Murphy and Raymond I. Dideriksen *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 66-77 (For availability see N76-26631 17-43)
CSCL 02C

The application of remote sensing technology by the U.S. Department of Agriculture (USDA) is examined. The activities of the USDA Remote-Sensing User Requirement Task Force which include cataloging USDA requirements for earth resources data, determining those requirements that would return maximum benefits by using remote sensing technology and developing a plan for acquiring, processing, analyzing, and distributing data to satisfy those requirements are described. Emphasis is placed on the large area crop inventory experiment and its relationship to the task force. J.M.S.

N76-26640* National Aeronautics and Space Administration, Washington, D.C.
FUTURE REMOTE-SENSING PROGRAMS
Russell L. Schweickart *In its* NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 79-82 (For availability see N76-26631 17-43)
CSCL 05B

User requirements and methods developed to fulfill them are discussed. Quick-look data, data storage on computer-compatible tape, and an integrated capability for production of images from the whole class of earth-viewing satellites are among the new developments briefly described. The increased capability of LANDSAT-C and Nimbus G and the needs of specialized applications such as, urban land use planning, cartography, accurate measurement of small agricultural fields, thermal mapping and coastal zone management are examined. The affect of the space shuttle on remote sensing technology through increased capability is considered. J.M.S.

N76-26641* Cargill, Inc., Minneapolis, Minn.
AGRICULTURE, SUMMARY
Richard Baldwin *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 83-97 (For availability see N76-26631 17-43)
CSCL 02C

Applications of remotely sensed data in agriculture are enumerated. These include: predictions of forage for range animal consumption, forest management, soil mapping, and crop inventory and management. J.M.S.

N76-26642* Chevron Oil Field Research Co., La Habra, Calif.
GEOLOGY, SUMMARY
Floyd F. Sabins, Jr. *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 99-121 refs (For availability see N76-26631 17-43)
CSCL 08G

Trends in geologic application of remote sensing are identified. These trends are as follows: (1) increased applications of orbital imagery in fields such as engineering and environmental geology - some specific applications include recognition of active earthquake faults, site location for nuclear powerplants, and recognition of landslide hazards; (2) utilization of remote sensing by industry, especially oil and gas companies, and (3) application of digital image processing to mineral exploration. Author

N76-26643* Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
INFORMATION/USER SERVICES, SUMMARY
David Landgrebe *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 123-127 (For availability see N76-26631 17-43)
CSCL 05B

Various aspects of the technology which are available to users now are described. Specific topics discussed include: data distribution: availability of and access to data; technology transfer: system use illustrations and availability of training; hardware systems descriptions: processing hardware constructed and available; data processing techniques: individual processing techniques; and future developments: a sampling of future technology. Author

N76-26644* Georgia Dept. of Natural Resources, Atlanta.
LAND USE/STATE AND LOCAL USERS, SUMMARY
Charles M. Parrish, III *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 129-150 refs (For availability see N76-26631 17-43)
CSCL 08B

Alternative approaches to remote sensing applications in state and local resource management problems are discussed. Examples

of application of remotely sensed data are given. User requirements for future applications are emphasized. J.M.S.

N76-26645* Colorado State Univ., Fort Collins.
WATER RESOURCES, SUMMARY
D. B. Simons *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-A Jun. 1975 p 151-171 (For availability see N76-26631 17-43)
CSCL 08H

The application of remote sensing products to the development and understanding of water resources problems is considered. Geology and hydrogeology, analysis of watersheds, snow and ice, prediction of runoff from snowmelt, hydrologic land use classifications, soil moisture, evapotranspiration, flood hazards, and water quality surveys are among the topics discussed. Suggestions for further use of remotely sensed data are given along with increased user requirements. J.M.S.

N76-26646*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
NASA EARTH RESOURCES SURVEY SYMPOSIUM. VOLUME 2-B: SPECIAL SESSION PRESENTATIONS. COASTAL ZONE MANAGEMENT, STATE AND LOCAL USERS, USER SERVICES
Jun. 1975 222 p refs Symp. held at Houston, 9-12 Jun. 1975 Original contains color illustrations
(NASA-TM-X-58168-Vol-2B; JSC-09930-Vol-2B) Avail: NTIS HC $3.50 CSCL 05B

Applications of remote sensing technology to environmental problems and resources management are presented. For individual titles, see N76-26647 through N76-26669.

N76-26647* National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
STATUS OF COASTAL ZONE MANAGEMENT TECHNIQUES
E. Lee Tilton, III *In its* NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 173-175 (For availability see N76-26646 17-43)
CSCL 08C

Remote panchromatic imagery was applied to develop a coastal zone management atlas that provides for land cover or vegetation surveys as well as land use stereographic mapping for regional planning purposes. G.G.

N76-26648* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
INFORMATION NEEDS: PERCEIVED AND REAL FOR STATE DECISIONMAKERS
A. R. Schwartz (Tex. State Senate), Chris Spirou (New Hampshire House of Representatives), William Kier (Senate Off. of Res.), and Michele Tetley (NOAA) *In its* NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 176-187 (For availability see N76-26646 17-43)
CSCL 05B

Remote sensing techniques provide important information for land and water use planning organizations in order to assess coastal developments and their impact on water resources, sediment transport, erosion, and marine biology. Political expediency requires pertinent data acquisition and data dissemination to local populations for coastal zone management decision making. G.G.

N76-26649* Delaware Univ., Newark.
APPLICATIONS OF REMOTE-SENSING TECHNOLOGY TO ENVIRONMENTAL PROBLEMS OF DELAWARE AND DELAWARE BAY
D. Bartlett, V. Klemas, W. Philpot, and R. Rogers (Bendix Aerospace Systems Div.) *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 188-194 refs (For availability see N76-26646 17-43)
CSCL 08C

Digital processing of multispectral LANDSAT data was used to develop a computerized model for predicting oil slick movement within the Delaware Bay. LANDSAT imagery was also used to monitor offshore waste disposal sites for mapping of wetlands, and charting of tidal currents. G.G.

N76-26650* Corps of Engineers, San Francisco, Calif.
CALIFORNIA NEARSHORE SURFACE CURRENTS
Douglas M. Pirie, Michael J. Murphy, and J. Robert Edmisten *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 195-216 refs (For availability see N76-26646 17-43)
CSCL 08C

During the oceanic period from July to November, the southward flowing California current dominates the nearshore current patterns. Commencing about the middle of November and extending to mid-February, the Davidson current, a northward moving countercurrent, is the dominant inshore transporter of water and suspensates. The phenomenon of upwelling is prevalent during the period from the middle of February to the end of July. Thus, every year along the coast of California, there are three successive current seasons: the oceanic, the Davidson, and the upwelling. This paper is a discussion of the nature of these nearshore currents. In addition, the capabilities of various remote sensing platforms and systems for providing methods of monitoring the coastal processes associated with the current seasons of California are demonstrated herein. Author

N76-26651* National Aeronautics and Space Administration. Earth Resources Labs., Bay St. Louis, Miss.
SOUTH LOUISIANA REMOTE-SENSING ENVIRONMENTAL INFORMATION SYSTEM
J. Paul Gordon (Corps of Engr., New Orleans), Robert H. Schroeder (Corps of Engr., New Orleans), and Robert H. Cartmill *In its* NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 217-223 (For availability see N76-26646 17-43)
CSCL 08F

Satellite gathered remote sensor data were used to update a basic environmental atlas of southern Louisiana to reflect recent dynamic geological changes, such as erosion by wave action along the coast and active delta building in the lower part of the Mississippi Basin. Standard pattern recognition programs were utilized to update LANDSAT pictures for three categories (generalized land use, ecological zones and vegetation) to obtain a simulated color photomap for LANDSAT frames for further rectification by a table lookup program. G.G.

N76-26652* Geological Survey of Alabama, University.
REMOTE MEASUREMENT OF SHORELINE CHANGES IN COASTAL ALABAMA
C. Daniel Sapp *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 224-231 refs (For availability see N76-26646 17-43)
CSCL 08C

It is shown that remotely sensed data, whether in digital or imagery form, provide objective, systematic measurements of coastal zone characteristics when compared with traditional measurement techniques. An example is given for Alabama shoreline parameters using LANDSAT 1 composite mapping. G.G.

N76-26653* Florida Coastal Coordinating Council, Tallahassee.
REMOTE-SENSING APPLICATIONS AS UTILIZED IN FLORIDA'S COASTAL ZONE MANAGEMENT PROGRAM
David R. Worley *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 232-241 (For availability see N76-26646 17-43)
CSCL 08C

Land use maps were developed from photomaps obtained by remote sensing in order to develop a comprehensive state plan for the protection, development, and zoning of coastal regions. Only photographic remote sensors have been used in support of the coastal council's planning/management methodology. Standard photointerpretation and cartographic application procedures for map compilation were used in preparing base maps. Author

N76-26654* Alaska Univ., Fairbanks. Geophysical Inst.
ENVIRONMENTAL ASSESSMENT OF RESOURCE DEVELOPMENT IN THE ALASKA COASTAL ZONE BASED ON LANDSAT IMAGERY
A. E. Belon, J. M. Miller, and W. J. Stringer *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 242-260 refs (For availability see

N76-26646 17-43)
(Contracts NAS5-21833; NAS5-20959; Grant NGL-02-001-092)
CSCL 08C

LANDSAT imagery was interpreted to derive color coded maps of the physical parameters of the Alaskan coastal zone. Synoptic overviews depict sea surface circulation, sediment transport, and ice cover dimensions. G.G.

N76-26655* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COAST GUARD/NOAA/NASA GREAT LAKES PROJECT ICEWARN
T. D. Brennan (Coast Guard 9th District) and R. T. Gedney *In its* NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 261-270 (For availability see N76-26646 17-43)
CSCL 08L

The operational feasibility of using remote sensing to provide all weather ice formation for Great Lakes winter navigation is explored. A combination airborne pulsed radar system to measure actual ice thickness, a satellite data link system, and a hand drawn interpretive ice chart proved valuable for extending winter navigation through the icepack. G.G.

N76-26656* Environmental Protection Agency, Washington, D.C.
OILSPILL SURVEILLANCE, DETECTION, AND EVALUATION BY REMOTE SENSING
Donald R. Jones *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 271-279 (For availability see N76-26646 17-43)
CSCL 13B

Aerial and fixed platform oil spill detection systems primarily utilize remote sensors for data acquisition and pollution monitoring purposes. In addition to aerial photography and infrared reflectance sensors, a laser backscatter sensor and an ultraviolet fluorescence sensor are considered for application in pollution surveillance systems. G.G.

N76-26657* Mississippi State Office of Science and Technology, Jackson.
REMOTE-SENSING APPLICATIONS IN THE STATE OF MISSISSIPPI
P. T. Bankston *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 282-290 (For availability see N76-26646 17-43)
CSCL 08B

A computer derived land use classification scheme for infrared LANDSAT imagery was developed and applied to update existing Mississippi coastline data. Inventory classifications were accomplished by photographic enlargement and photointerpretations showing color coded resources on the ground. G.G.

N76-26658* State Planning Office, Madison, Wis.
INFORMATION FLOW OF LAND AND WATER-RELATED DATA IN THE STATE OF WISCONSIN
Allen H. Miller *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 291-296 (For availability see N76-26646 17-43)
CSCL 05B

Digital data from the infrared LANDSAT imagery were used to classify eutrophication levels of lakes in an effort to observe the effect of thermal discharges from power stations. LANDSAT data were also applied to identify and monitor wetlands, for soil surveys, sedimentation transport, and in general to assist in land use planning and resources management. G.G.

N76-26659* Governor's Office of Information Services, Austin, Tex.
REMOTE-SENSING APPLICATIONS FOR TEXAS
John Wells *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 297-299 (For availability see N76-26646 17-43)
CSCL 05B

The earth resources remote sensing activity of Texas and its applications are reported. A combination of digital, photographic, and traditional methods is being used to manage the water impoundments inventory, a land use survey, a wildlife habitat survey, and a coastal zone survey. G.G.

N76-26660* Arizona Resources Information System, Phoenix.
REMOTE SENSING IN ARIZONA
Carl C. Winikka and Robert E. Adams (Ariz. Dept. of Transportation) *In its* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 300-314 (For availability see N76-26646 17-43)
CSCL 05B

Orthophotoquads prepared from high altitude photography and LANDSAT imagery were utilized for land use mapping and urban development planning. LANDSAT imagery of rough terrains were evaluated by photographic projection on a viewer screen for enlargement of details. G.G.

N76-26661* Joint Federal-State Land Use Planning Commission for Alaska, Juneau.
ALASKA'S NEEDS IN REMOTE SENSING
John L. Hall *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 315-318 (For availability see N76-26646 17-43)
CSCL 05B

Joint Federal/State remote data sensing centers are advocated to help survey Alaska for land use planning by aerial photography and LANDSAT imagery. The centers are to provide satellite derived information in land use planning and offshore oil developments. G.G.

N76-26662* Tennessee Valley Authority, Norris.
USER REQUIREMENTS FOR PROJECT-ORIENTED REMOTE SENSING
H. C. Hitchcock, F. P. Baxter, and T. L. Cox (Remote Sensing Inst.) *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 319-325 refs (For availability see N76-26646 17-43)
CSCL 05B

Registration of remotely sensed data to geodetic coordinates provides for overlay analysis of land use data. For aerial photographs of a large area, differences in scales, dates, and film types are reconciled, and multispectral scanner data are machine registered at the time of acquisition. G.G.

N76-26663* Louisiana Office of State Planning, Baton Rouge.
LOUISIANA COMPREHENSIVE PLANNING INFORMATION SYSTEM
Patrick W. Ryan and Ed. Schwertz *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 326-339 (For availability see N76-26646 17-43)
CSCL 05B

A statewide computerized land use mapping system is reported that uses polygons to identify inventories from aerial photography by employing the USGS classification system. In addition, the system provides soil, population, and housing census data as well as economic indicators that can be useful in relating to the overall system. G.G.

N76-26664* Minnesota State Planning Agency, St. Paul.
REMOTE SENSING IN MINNESOTA: EVALUATION OF PROGRAMS AND CURRENT NEEDS
J. E. Sizer *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 340-350 (For availability see N76-26646 17-43)
CSCL 05B

Aerial photographs of the entire state were used to develop information on geomorphic regions, land ownership, forest cover, soils, geology, land classification and land capability. LANDSAT imagery was included to update many photomaps for land use classification and urban development planning. G.G.

N76-26665* Ohio Dept. of Economic and Community Development, Columbus.
REMOTE SENSING IN THE STATE OF OHIO. 1. PUBLIC POLICY. 2. SYSTEM DEVELOPMENT
Paul Goesling and Frank Leone *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 351-355 (For availability see N76-26646 17-43)
CSCL 05B

Different types of satellite and conventional remote sensing data are used to monitor urban growth and the pattern of development. Software programs were developed for a growth

allocation model that uses LANDSAT information as the basic component. G.G.

N76-26666* Ohio-Kentucky-Indiana Regional Council of Governments, Cincinnati.
THE USE OF SATELLITE DATA FOR REGIONAL PLANNING
A. H. Hessling and Timothy G. Mara *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 356-358 (For availability see N76-26646 17-43)
CSCL 05B

The experience of the Ohio-Kentucky-Indiana Regional Council of Governments in its development of a regional land use inventory from computer processing of LANDSAT 1 digital tapes and the use of those data in the OKI water quality planning program are discussed. A major part of the planning program is the prediction of water quality in rivers and lakes resulting from existing and future land uses. A model has been developed that can predict the flow of sediment, total phosphorus, total nitrogen, and organic wastes into major streams. An essential input to this model is an accurate map of land use derived from LANDSAT 1 digital tapes. Author

N76-26667* Department of City Planning, Los Angeles, Calif.
POLICY IMPLICATIONS IN DEVELOPING A LAND USE MANAGEMENT INFORMATION SYSTEMS
Albert J. Landini *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 359-365 (For availability see N76-26646 17-43)
CSCL 05B

The current land use map for the city of Los Angeles was developed by the guesstimation process and provides single stage information for each level in the critical geographical hierarchy for land use planning management. Processing and incorporation of LANDSAT data in the land use information system requires special funding; however, computergraphic maps are able to provide a viable information system for city planning and management. G.G.

N76-26668* Purdue Univ., Lafayette, Ind. Lab. for Applications of Remote Sensing.
REMOTE SENSING, A SKETCH OF THE TECHNOLOGY
David Landgrebe *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 367-370 (For availability see N76-26646 17-43)
CSCL 05B

Information is provided on how a potential user of remote sensing technology can gain access to all of the products and services he will need to get started. It was envisioned that these include data, training, hardware, and software. A very brief tutorial summary of the fundamentals of the technology is presented. Author

N76-26669* EROS Data Center, Sioux Falls, S. Dak.
DATA AVAILABILITY AND THE ROLE OF THE EARTH RESOURCES OBSERVATION SYSTEMS DATA CENTER
Allen H. Watkins *In* NASA. Lyndon B. Johnson Space Center NASA Earth Resources Survey Symp., Vol. 2-B Jun. 1975 p 372-378 (For availability see N76-26646 17-43)
CSCL 05B

With the launch of LANDSAT-1 in July 1972, and the follow-on launch of LANDSAT-2 in January of this year, routine availability of satellite imagery and electronic data of the earth's resources has become a reality. Federal data centers provide LANDSAT data to resource managers and the general public. These data centers have to date provided almost 500,000 frames of LANDSAT data at a cost of more than $2,000,000. Data from the LANDSAT satellite program, along with data and information from the Skylab manned program, are available over any location to anyone for the cost of reproduction. Author

N76-26670*# Auburn Univ., Ala. Industrial Engineering and Mechanical Engineering Dept.
DEVELOPMENT OF ALABAMA RESOURCES INFORMATION SYSTEM, ARIS Annual Report, 1 Jul. 1974 - 1 May 1976
B. E. Herring and R. I. Vachon 1 May 1976 83 p
(Contract NAS8-30654)
(NASA-CR-144342; ALA-AU-X996-1060-5) Avail: NTIS HC $5.00 CSCL 08F

The design and implementation of a working, user-oriented set of computer procedures which permit the storage, retrieval, and manipulation of geographic and demographic data are described. Author

N76-26671*# National Aeronautics and Space Administration, Washington, D.C.
INPUTS REQUESTED FROM EARTH RESOURCES REMOTE SENSING DATA USERS REGARDING LANDSAT-C MISSION REQUIREMENTS AND DATA NEEDS
1976 27 p refs
(NASA-TM-X-73007; NASA-AN-OA-76-B) Avail: NTIS HC $4.00 CSCL 08B

Inputs from prospective LANDSAT-C data users are requested to aid NASA in defining LANDSAT-C mission and data requirements and in making decisions regarding the scheduling of satellite operations and ground data processing operations. Design specifications, multispectral band scanner performance characteristics, satellite schedule operations, and types of available data products are briefly described. J.M.S.

N76-26672# Florida State Univ., Tallahassee. Dept. of Urban and Regional Planning.
FLORIDA COASTAL POLICY STUDY: THE IMPACT OF OFFSHORE OIL DEVELOPMENT Final Report
Allen L. Pearman and John W. Stafford (Univ. of South Fla.) Jun. 1976 284 p refs
Avail: NTIS HC $9.25

The impacts of possible offshore oil and gas discoveries upon the coastal areas of Florida are examined. Offshore oil and gas developments are studied from a number of perspectives: economic, environmental, legal, and social. A set of policy alternatives are identified which can be implemented to guide and regulate onshore developments so as to minimize the adverse impacts upon the areas most directly affected. The analysis of onshore impacts is based, in part, upon a review of similar developments in other coastal areas. The development of an information base which can be applied to potential developments in Florida is viewed as an essential element of this study. Author

N76-26673*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN ESTIMATE OF THE INFLUENCE OF SEDIMENT CONCENTRATION AND TYPE ON REMOTE SENSING PENETRATION DEPTH FOR VARIOUS COASTAL WATERS
Charles H. Whitlock Mar. 1976 18 p refs
(NASA-TM-X-73906) Avail: NTIS HC $3.50 CSCL 08J

Under the assumptions of collimated light, a homogenous water column, zero molecular scattering, and constant ratio of volume scattering function to scattering coefficient, estimates of the remote sensing depth parameter, Z90, are made for various coastal waters at 540 nm. Calculations indicate that sediment concentration and type have a strong influence on remote sensing depth when concentrations are below 5 mg/theta. Above 5 mg/theta, the absorption coefficient of the sediments becomes large in comparison to that of water, causing Z90 values to be less than 2 m with only small differences between various sediment types. Author

N76-26674*# Battelle Columbus Labs., Ohio.
SURVEY OF USERS OF EARTH RESOURCES REMOTE SENSING DATA Final Report
G. E. Wukelic, J. G. Stephan, H. E. Smail, L. Landis, and T. F. Ebbert 31 Mar. 1976 154 p refs
(Contract NASw-2800)
(NASA-CR-147361) Avail: NTIS HC $6.75 CSCL 08A

A user survey was conducted to determine current earth resources survey (ERS) data use/user status and recommendations for strengthening use. Only high-altitude aircraft and satellite (primarily LANDSAT) data were included. Emphasis was placed on the private sector/industrial user. Objectives of the survey included: who is using ERS data, how they are using the data, the relative value of current data use as well as obtaining user views as to possible ways of strengthening future ERS data

use. The survey results are documented and should provide relevant decision making information for developing future programs of maximum benefit to all end users of satellite ERS data. Author

N76-26675*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Division.
ATMOSPHERIC MODELING RELATED TO THEMATIC MAPPER SCAN GEOMETRY Final Report, 6 Feb. - 31 Mar. 1976
W. A. Malila, J. M. Gleason, and R. C. Cicone Apr. 1976 132 p refs
(Contract NAS9-14819)
(NASA-CR-147792; ERIM-119300-5-F) Avail: NTIS HC $6.00 CSCL 04A

A simulation study was carried out to characterize atmospheric effects in LANDSAT-D Thematic Mapper data. In particular, the objective was to determine if any differences would result from using a linear vs. a conical scanning geometry. Insight also was gained about the overall effect of the atmosphere on Thematic Mapper signals, together with the effects of time of day. An added analysis was made of the geometric potential for direct specular reflections (sun glint). The ERIM multispectral system simulation model was used to compute inband Thematic Mapper radiances, taking into account sensor, atmospheric, and surface characteristics. Separate analyses were carried out for the thermal band and seven bands defined in the reflective spectral region. Reflective-region radiances were computed for 40 deg N, 0 deg, and 40 deg S latitudes; June, Mar., and Dec. days; and 9:30 and 11:00 AM solar times for both linear and conical scan modes. Also, accurate simulations of solar and viewing geometries throughout Thematic Mapper orbits were made. It is shown that the atmosphere plays an important role in determining Thematic Mapper radiances, with atmospheric path radiance being the major component of total radiances for short wavelengths and decreasing in importance as wavelength increases. Path radiance is shown to depend heavily on the direct radiation scattering angle and on haze content. Scan-angle-dependent variations were shown to be substantial, especially for the short-wavelength bands. Author

N76-26676# Oak Ridge National Lab., Tenn.
ANALYSIS APPLICATION OF LAND-USE DATA
A. H. Voelker 1975 19 p refs Presented at Proc. of Am. Soc. of Photogrammetry, Arizona, 26-30 Oct. 1975 Sponsored in part by ERDA and NSF
(CONF-751064-1) Avail: NTIS HC $4.50

The ever broadening scope of planning requires improved techniques for gathering, manipulating and displaying spatial information. Fortunately, the combination of high altitude photography as a potential data source and computer based geographical information systems as a means of achieving efficient data manipulation offer the planner powerful analysis capability. The utility is demonstrated of land-use data extracted from high altitude photography in the development of a computerized land use model. A technique is explained for synthesizing mapped land-use data categorized in the Anderson Classification System with other spatial variables to create an abstract index of land use compatibility. The questions of resolution, accuracy, index validation, and index display are considered. Finally, some observations are made about the applicability of computer analysis using remote-sensor data. Author (ERA)

N76-26677# North Central Forest Experiment Station, St. Paul, Minn.
INTRODUCTION TO USES AND INTERPRETATION OF PRINCIPAL COMPONENT AND ANALYSIS IN FOREST BIOLOGY Forest Service General Technical Report
J. G. Isebrands and Thomas R. Crow Jan. 1976 24 p refs (PB-248753/6; FSGTR-NC-17) Avail: NTIS HC $3.50 CSCL 02F

The application of principal component analysis for interpretation of multivariate data sets is reviewed with emphasis on reduction of the number of variables, ordination of variables, and applications in conjunction with multiple regression. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N76-26678 Clemson Univ., S.C.
A TOTAL SYSTEMS PLAN FOR A MOBILE SOLAR LABORATORY Ph.D. Thesis
Ibrahim Khaled Kellizy 1975 316 p
Avail: Univ. Microfilms Order No. 76-12960

The performance of a hypothetical solar house in Clemson, South Carolina, is simulated using insolation and weather data in addition to conservative heat loss estimates. Based on the simulation, parametric system design and optimization are undertaken. The potential and impact of solar energy utilization is considered in the sphere of a national energy policy. A public education program is developed for a mobile solar laboratory to tour Southeastern States. Statistical analysis of solar radiation and weather parameters at various locations in the Southeast is undertaken. The selection of cities to be visited by the solar laboratory is based on the dual objective of (1) demonstrating solar systems to the public and (2) collecting weather and performance data at different climatological areas. Industry demand schedules and elasticities of demand are developed, and the feasibility of solar energy utilization is analyzed. Dissert. Abstr.

N76-26679 Wisconsin Univ., Madison.
ECONOMICS OF SUPERCONDUCTIVE ENERGY STORAGE INDUCTOR-CONVERTER UNITS IN POWER SYSTEMS Ph.D. Thesis
Sambasiva Rao Yadavalli 1975 182 p
Avail: Univ. Microfilms Order No. 76-6114

The economic aspects of using superconductive energy storage inductor converter units (IC units) in large power systems for peak shaving and load leveling were studied. The daily load characteristics of power systems, electrical external circuit losses in the IC units and the advantages and disadvantages of IC units were considered. The peak power problem in power systems and the status of various peaking alternatives were investigated, and daily load model was developed. The competitiveness of IC units with other peaking units was then investigated; advantages and disadvantages were translated into credits and debits. Large IC units were found to be economically competitive with other peaking alternatives. External electrical circuit losses were determined to have negligible effect on their storage and power capacities. Credits which could be of significant economic value to IC units are a transmission credit (typically about $35/kW), a pollution credit (typically about $80/kW), and a spinning reserve credit (typically about $90/kW). Dissert. Abstr.

N76-26680 George Washington Univ., Washington, D.C.
THE ENERGY SYSTEM OF THE UNITED STATES Ph.D. Thesis
James Arthur White 1975 205 p
Avail: Univ. Microfilms Order No. 76-11258

Recent events have demonstrated the critical dependence of the economy of the United States on energy resources and have suggested the need for a precise definition of the components of the energy system and its expected future direction. The data necessary to define the composition of the energy system, the determinants of its performance, the future requirements for energy resources, and the factors which will affect the availability and use of these resources was developed. A methodology for integrating the data developed in the initial phase of the research into energy balance for the period from 1975 to 2000 was found. Policies for the optimal management of the energy resources of the United States were formulated. Dissert. Abstr.

N76-26681 Stanford Univ., Calif.
LABORATORY STUDIES OF STIMULATED GEOTHERMAL RESERVOIRS Ph.D. Thesis
Anstein Hunsbedt 1976 252 p
Avail: Univ. Microfilms Order No. 76-13020

Improved recovery of geothermal energy from artificially stimulated systems by in-place flashing was studied experimentally. The laboratory model used produces steam from initial pressures and temperatures up to 800 psia (54.4 bar) and 500 F (260 C). Thermocouples were used to measure the steam temperature and the center temperature of rocks at various points in the rock matrix. Analytic solutions were derived for the rock thermal transients for comparison to measurements. Analytic models were developed for the model pressure and temperature transients based on mass and energy balances assuming uniform axial temperature distribution. The thermal characteristics of the laboratory model were determined from heatup and cooldown calibration experiments and from fluid production experiments with water only in the model. Results show that thermal energy stored in fractured rock can be extracted effectively by reducing system pressure to allow in-place flashing. Dissert. Abstr.

N76-26682# Committee on Interior and Insular Affairs (U. S. Senate).
GREATER COAL UTILIZATION, PART 3
Washington GPO 1975 1768 p refs Joint hearings on S. 1777 before Comm. on Interior and Insular Affairs and Comm. on Public Works, 94th Congr., 1st Sess., 1975
(GPO-55-305) Avail: Comm. on Interior and Insular Affairs

Joint hearings held before the Committees on Interior and Insular Affairs and Public Works of the U.S. Senate, dealing with greater coal utilization, were reported. These hearings were held in relation to proposed legislation requiring that new, and to the extent practicable, existing electric powerplant boilers and major industrial boilers utilizing fossil fuels should be capable of utilizing coal as their primary energy fuel in conformity with applicable environmental requirements, and for other purposes. The report consists primarily of communications submitted by utility companies, railways, and manufacturers of boilers and other equipment used for power generation. Y.J.A.

N76-26683*# South Carolina Univ., Columbia. College of Engineering.
WEB-DENDRITIC RIBBON GROWTH Quarterly Report, 1 Jan. 1976 - 31 Mar. 1976
R. B. Hilborn, Jr. and J. W. Faust, Jr. 17 Mar. 1976 29 p refs
(Contracts NAS7-100; JPL-954344)
(NASA-CR-148289; USC-Q-2; ERDA/JPL-954344/76-1) Avail: NTIS HC $4.00 CSCL 10A

The purpose of this investigation is to develop web-dendritic process methods that will: (1) minimize the cost of processing silicon into ribbons of solar cell quality with a terrestrial energy conversion efficiency greater than 10%, and (2) be suitable for large quantity production. Work is described on: (1) the procedures used to calibrate and operate the web-dendritic growth furnace, (2) use of the furnace to grow web-dendritic ribbon, (3) considerations applied for the thermal analysis and modeling of the web-dendritic growth system, and (4) procedures, facilities and initial results for the structural and electrical characterization of web material. Author

N76-26684*# Mobil Tyco Solar Energy Corp., Waltham, Mass.
LARGE AREA SILICON SHEET BY EFG Quarterly Progress Report, 1 Jan. 1976 - 31 Mar. 1976
A. D. Morrison, K. V. Raui, C. V. Hari Rao, T. Surek, D. H. F. Bliss, and L. C. Garone 15 Mar. 1976 45 p refs Prepared for JPL
(Contracts NAS7-100; JPL-954355)
(NASA-CR-148285; ERDA/JPL-954355/76-1; QPR-2) Avail: NTIS HC $4.00 CSCL 10A

The thin-fast growth system is modified and operational. An orientation study was run on this system prior to the changeover and thermal geometry experiments have been run since. (110) [211] seed orientation appears to be the optimum. Solar cells have been fabricated from the ribbon material and tested. The wide ribbon system is being designed. The theoretical analysis of heat flow in EFG silicon growth is expanded. Author

N76-26685*# Motorola, Inc., Phoenix, Ariz.
PHASE 1 OF THE AUTOMATED ARRAY ASSEMBLY TASK OF THE LOW COST SILICON SOLAR ARRAY PROJECT Technical Quarterly Report, Apr. 1976
M. Coleman Apr. 1976 47 p Prepared for JPL
(Contract JPL-954363)
(NASA-CR-148284; UC-63; Motorola-2258/1; ERDA-JPL-954363-76/1) Avail: NTIS HC $4.00 CSCL 10A

Phase I of the Automated Array Assembly Task is concerned with a comprehensive assessment of the improvements in existing technology that may be needed in order to develop, by 1985, an industrial capability for low cost, mass production of very durable silicon solar photovoltaic modules and arrays. Design criteria for efficient solar cells are discussed, emphasis being given to front metal surface pattern and texture etched front surfaces. A generalized processing matrix, containing competing methods for solar cell manufacturing steps, is outlined. The steps in this processing matrix are discussed and characterized according to immediate and potential usefulness. Author

N76-26686*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PRELIMINARY ASSESSMENT OF THE FEASIBILITY OF DERIVING LIQUID AND GASEOUS FUELS FROM GROWN AND WASTE ORGANICS
Robert W. Graham, Thaine W. Reynolds, and Yih-Yun Hsu 1976 9 p refs Presented at 11th Intersociety Energy Conversion Engr. Conf., State Line, Nev., 12-17 Sep. 1976
(NASA-TM-X-73441; E8463) Avail: NTIS HC $3.50 CSCL 21D

The anticipated depletion of our resources of natural gas and petroleum in a few decades has caused a search for renewable sources of fuel. Among the possibilities is the chemical conversion of waste and grown organic matter into gaseous or liquid fuels. The overall feasibility of such a system is considered from the technical, economic, and social viewpoints. Although there are a number of difficult problems to overcome, this preliminary study indicates that this option could provide between 4 and 10 percent of the U.S. energy needs. Estimated costs of fuels derived from grown organic material are appreciably higher than today's market price for fossil fuel. The cost of fuel derived from waste organics is competitive with fossil fuel prices. Economic and social reasons will prohibit the allocation of good food producing land to fuel crop production. Author

N76-26687*# Naval Weapons Support Center, Crane, Ind.
CYCLE LIFE TEST. EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS Annual Report
J. D. Harkness 11 Feb. 1976 278 p
(Contract S-53742AG)
(NASA-CR-148208; WQEC/C-76-5; AR-12) Avail: NTIS HC $9.25 CSCL 10C

Considerable research is being done to find more efficient and reliable means of starting electrical energy for orbiting satellites. Rechargeable cells offer one such means. A test program is described which has been established in order to further the evaluation of certain types of cells and to obtain performance and failure data as an aid to their continued improvement. The purpose of the program is to determine the cycling performance capabilities of packs of cells under different load and temperature conditions. The various kinds of cells tested were nickel-cadmium, silver-cadmium, and silver-zinc sealed cells. A summary of the results of the life cycling program is given in this report. Author

N76-26688*# Naval Weapons Support Center, Crane, Ind.
ACCELERATED TEST PROGRAM FOR SEALED NICKEL-CADMIUM SPACECRAFT BATTERIES/CELLS Interim Report
L. A. Goodman 13 Feb. 1976 78 p
(NASA Order S-53742-AG)
(NASA-CR-148209; WQEC/C-76-8) Avail: NTIS HC $5.00 CSCL 10C

The feasibility was examined of inducing an accelerated test on sealed Nickel-Cadmium batteries or cells as a tool for spacecraft projects and battery users to determine: (1) the prediction of life capability; (2) a method of evaluating the effect of design and component changes in cells; and (3) a means of reducing time and cost of cell testing. Author

N76-26689*# National Aeronautics and Space Administration. Pasadena Office, Calif.

THREE-DIMENSIONAL TRACKING SOLAR ENERGY CONCENTRATOR AND METHOD FOR MAKING SAME Patent Application

Charles G. Miller (JPL) and Jens G. Pohl, inventors (to NASA) (JPL) Filed 28 Apr. 1976 14 p Sponsored by NASA

(NASA-Case-NPO-13736-1; US-Patent-Appl-SN-681017) Avail: NTIS HC $3.50 CSCL 10A

A tracking three dimensional solar energy concentrator is provided by a stretched aluminized polymeric membrane supported by a hoop. The membrane is formed to a desired curvature by differential loading, which determines its curvature. The loading can be varied by utilizing a plastic membrane that has a nonuniform radial distribution of thickness with uniform differential pressure or by applying a nonuniform differential pressure on a membrane having uniform thickness. Reflector membranes having a nonuniform radial distribution of thickness can be obtained by selective spraying of a dissolved plastic such as Krylon on the underside of the aluminized membrane. A nonuniform differential pressure is obtained by using a uniform differential pressure in combination with localized electrostatic or magnetic pressure. The membrane concentrator and its supporting equipment are maintained in a slightly pressurized spherical-cap envelope of transparent plastic to protect the concentrator from the elements. NASA

N76-26690*# National Aeronautics and Space Administration. Pasadena Office, Calif.

PORTABLE, LINEAR-FOCUSED SOLAR THERMAL ENERGY COLLECTING SYSTEM Patent Application

Charles G. Miller (JPL) and Jens G. Pohl, inventors (to NASA) (JPL) Filed 28 Apr. 1976 24 p Sponsored by NASA

(NASA-Case-NPO-13734-1; US-Patent-Appl-SN-680939) Avail: NTIS HC $3.50 CSCL 10A

A solar heat collection system is provided by utilizing a line focusing device that is effectively a cylindrically curved concentrator within a protected environment formed by a transparent inflatable casing. A target, such as a fluid or gas carrying conduit is positioned within or near the casing containing the concentrator, at the line focus of the concentrator. The casing can be inflated at the site of use by a low pressure air supply to form a unitary light weight structure. When deflated, the collector is readily transportable. A system constructed from several line focusing devices can be used either at ground level or on rooftops. A system may advantageously utilize parallel aligned heat absorbing rigid conduits as targets, each conduit supporting an inflatable concentrator and casing. In particular cases the inflatable concentrator can be replaced with a rigid metal or other concentrator. NASA

N76-26691*# National Aeronautics and Space Administration. Pasadena Office, Calif.

A SOLAR ENERGY COLLECTION SYSTEM Patent Application

M. Kudret Selcuk, inventor (to NASA) (JPL) Filed 28 Apr. 1976 18 p Sponsored by NASA

(NASA-Case-NPO-13810-1; US-Patent-Appl-SN-681096) Avail: NTIS HC $3.50 CSCL 10A

A solar energy collection system is described which includes several energy receivers supported in suspension by an array of radially extending booms. The receivers are suspended above a field of heliostats which serves to reflect beams of solar energy toward the receivers. Each of the receivers is characterized by a curved target surface substantially totally illuminated by the reflected beam. A network of interconnected conduits is included for conducting a working fluid along a tortuous path in juxtaposition with the target surface of each receiver. The working fluid is heated for converting radiant energy to heat, and a network of conduits collects and conducts the heated working fluid away from the receivers. NASA

N76-26692*# National Aeronautics and Space Administration. Pasadena Office, Calif.

RF BEAM CENTER LOCATION METHOD AND APPARATUS FOR POWER TRANSMISSION SYSTEM Patent Application

Richard M. Dickinson, inventor (to NASA) (JPL) Filed 21 May 1976 14 p Sponsored by NASA

(NASA-Case-NPO-13821-1; US-Patent-Appl-SN-688852) Avail: NTIS HC $3.50 CSCL 20N

For wireless power transmission systems, planar array of receiver elements symmetrically located about a physical center makes it possible to determine the location on the array of the center of energy of the incident beam. This information is obtained as follows. Sum the output energy of all the receiver elements to the right and left of the vertical center of the array. Determine the difference and sum of these two amounts. Divide the difference by the sum. The result is an indication of the degrees that the center of the incident beam is off in azimuth. Sum the output energy of all the receiver elements above and below the horizontal center of the array. Determine the difference and sum of these two amounts. Divide the difference by the sum. The result is an indication of the degrees that the center of the incident beam is off in elevation. NASA

N76-26693*# Naval Weapons Support Center, Crane, Ind.

EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: INITIAL EVALUATION TESTS OF GENERAL ELECTRIC COMPANY 12.0 AMPERE-HOUR NICKEL-CADMIUM SPACECRAFT CELLS FOR THE INTERNATIONAL ULTRAVIOLET EXPLORER

J. D. Harkness 15 Mar. 1976 17 p

(NASA Order S-53742-AG)

(NASA-CR-148190; WQEC/C-76-89) Avail: NTIS HC $3.50 CSCL 10C

An evaluation test program was conducted to insure that all cells put into the life cycle program are of high quality by the screening of cells found to have electrolyte leakage, internal shorts, low capacity, or inability of any cell to recover its open-circuit voltage above 1.150 volts during the internal short test. The 20 cells were manufactured for the National Aeronautics and Space Administration, Goddard Space Flight Center (GSFC). The cells are from a lot of 175 cells procured for the International Ultraviolet Explorer project. Due to a change in requirements, the project selected to use 6.0 ampere-hour cells. Therefore, the remaining cells of this lot have been placed in storage at GSFC for use on a future GSFC project. All the cells are rated at 12.0 ampere-hours and contain double ceramic seals. Test limits specify those values in which a cell is to be terminated from a particular charge or discharge. Requirements are referred to as normally expected values based on past performance of aerospace nickel cadmium cells with demonstrated life characteristics. Author

N76-26694*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL INVESTIGATION OF THE EXCESS CHARGE AND TIME CONSTANT OF MINORITY CARRIERS IN THE THIN DIFFUSED LAYER OF 0.1 ohm-cm SILICON SOLAR CELLS

M. P. Godlewski, Henry W. Brandhorst, Jr., F. A. Lindholm (Fla. Univ., Gainesville), and C. T. Sah (Ill. Univ., Urbana) 1976 7 p refs Presented at Mater. Res. Conf., Salt Lake City, 23-25 Jun. 1976; Sponsored by the Am. Inst. of Mining, Met., and Petrol. Engr.

(NASA-TM-X-73455; E-8814) Avail: NTIS HC $3.50 CSCL 10A

An experimental method is presented that can be used to interpret the relative roles of bandgap narrowing and recombination processes in the diffused layer. This method involves measuring the device time constant by open-circuit voltage decay and the base region diffusion length by X-ray excitation. A unique illuminated diode method is used to obtain the diode saturation current. These data are interpreted using a simple model to determine individually the minority carrier lifetime and the excess charge. These parameters are then used to infer the relative importance of bandgap narrowing and recombination processes in the diffused layer. Author

N76-26695*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

IMPROVED LOW COST SUBSTRATES FOR POLYCRYSTALLINE SOLAR CELLS Patent Application

Ting Lee Chu, inventor (to NASA) (Southern Methodist Univ.) Filed 4 Jun. 1976 40 p Sponsored by NASA

(NASA-Case-GSC-12022-2; US-Patent-Appl-SN-693074) Avail: NTIS HC $4.00 CSCL 10A

Low cost polycrystalline silicon solar cells supported on substrates are prepared by depositing successive layers of polycrystalline silicon containing appropriate dopants over supporting substrates. The substrates are selected from the group consisting of metallurgical-grade polycrystalline silicon, graphite, and steel coated with a diffusion barrier of silica, borosilicate, or phosphosilicate. Semiconductor p-n junction devices are formed which effectively convert solar energy to electrical energy. To improve the conversion efficiency of the polycrystalline silicon solar cells, the crystallite size in the silicon is substantially increased by melting and solidifying a base layer of polycrystalline silicon before depositing the layers which form the p-n junction. NASA

N76-26696# Committee on Agriculture and Forestry (U. S. Senate).

IMPACT OF ENERGY DECONTROL ON AGRICULTURE

Washington GPO 1975 60 p Hearing before Subcomm. on Agricultural Credit and Rural Electrification of Comm. on Agriculture and Forestry, 94th Congr., 1st Sess., 9 Sep. 1975 (GPO-39-102) Avail: Subcomm. on Agricultural Credit and Rural Electrification

The impact of the decontrol of petroleum on the food and agriculture sector is assessed in relation to the increased curtailments of natural gas supplies. Requirements of propane fuels for farm production needs as well as home heating needs are considered. J.M.S.

N76-26697# Committee on Government Operations (U. S. House).

SYNTHETIC GASOLINE

Washington GPO 1975 31 p Hearing before a subcomm. of the Comm. on Govt. Operations, 94th Congr., 1st Sess., 23 Sep. 1975

(GPO-59-975) Avail: Comm. on Govt. Operations

A method is described for producing synthetic benzene and its derivatives for use as major gasoline extenders. A feedstock material containing carbon (limestone has been used) is mixed with lithium metal in a stainless steel vessel, evacuated, and heated to 2,000 F. The molten metal attacks the carbon in the feedstock to form carbides, with a conversion efficiency of 90%. The material is then allowed to cool and water is added to form acetylene gas, which is catalyzed to form benzene with a conversion efficiency of almost 100%. The benzene is consistently pure; any sulfur or ash is left behind, regardless of the sulfur content of the feedstock material. Other feedstock materials considered are charcoal, coke, high sulfur coal and various types of organic wastes. The estimated cost of the product, using low grade coke or coal as the feedstock material, is $15-$20 per barrel. D.M.L.

N76-26698# Brookhaven National Lab., Upton, N.Y.

ERDA/NATIONAL LABORATORIES WORKSHOP ON ENVIRONMENTAL EFFECTS OF ENERGY

1975 141 p Workshop held at New York, 4-5 Sep. 1975

(Contract E(30-1)-16)

(BNL-20701) Avail: NTIS HC $7.00

The important environmental impacts of energy production are summarized. A summary of these impacts associated with each step of the nuclear fuel cycle is included. ERA

N76-26699+ Energy Research and Development Administration, Washington, D.C.

WORLD ENERGY RESOURCES: AN ANNOTATED BIBLIOGRAPHY OF SELECTED MATERIAL ON THE AVAILABILITY AND DEVELOPMENT OF WORLD ENERGY RESOURCES

1975 21 p

(ERDA-53) Avail: NTIS HC $4.50

The bibliography provides references to 173 recent English language publications covering the availability and development of world energy resources. Citations dealing exclusively with energy resources of the United States have been omitted. The references are sources of statistical and general energy policy information, not technical descriptions of resource development. Most of the items chosen (from books, journal articles, and reports) were published since 1972. The bibliography is divided into sections and within sections by year of publication and then alphabetically by title. The four general sections include citations that cover several types of energy resources in more than one country. Citations of energy resources in more than one country are given for coal, peat, oil shale, tar sands, petroleum, natural gas, geothermal hydraulics, nuclear energy, solar energy, ocean thermal gradients, tidal power, wind power, and wastes. ERA

N76-26700# Brookhaven National Lab., Upton, N.Y.

ENTHALPY MANAGEMENT IN BUILDINGS: AN ANALYSIS AND AN INTEGRATED APPROACH

A. L. Berlad, F. J. Salzano, and J. Batey Jul. 1975 47 p refs Sponsored by ERDA

(BNL-20572) Avail: NTIS HC $5.45

Enthalpy management requirements of residential and small commercial buildings are analyzed, and integrated approaches to energy efficient and cost effective heating and cooling schemes are proposed. Improved design and operating strategies are suggested to make more efficient use of off-the-shelf (or other readily accessible) technology for space conditioning. Thermal storage devices, techniques, and special operational strategies are central to these approaches. Fossil fuel heaters, heat pumps, solar collectors, and electric driven air coolers, all can be used more efficiently when effectively interfaced with selected thermal storage systems. A central heated (fossil fuel) and cooled (electric air conditioner) residence located in Long Island, New York, is considered as an example. It is found that the revised operating approach leads to 50 percent savings in space conditioning costs, with the basic functional features of the building unchanged, and assuming it is no better insulated than a typical well insulated frame residence. Additional insulation results in further savings. ERA

N76-26701# California Univ., Livermore. Lawrence Livermore Lab.

ENERGY AND TECHNOLOGY REVIEW

R. B. Carr Dec. 1975 29 p refs

(Contract W-7405-eng-48)

(UCRL-52000-75-12) Avail: NTIS HC $4.00

Brief discussions are given on research work at the National CTR Computer Center at Livermore, high-field superconducting magnets for fusion reactors, and digital image processing for plasma diagnostics. Some developmental work on multifilamentary superconductors of Nb-Ti and Nb-Sn is described. Some complex mathematical techniques for enhancing and restoring digital images for plasma diagnostics are discussed. NSA

N76-26702# Battelle Memorial Inst., Geneva (Switzerland). Research Centre.

EXPLORATORY STUDY OF HYDROGEN/SILVER OXIDE BATTERIES FOR SPACE APPLICATION Final Report [ETUDE EXPLORATOIRE CONCERNANT LES ACCUMULATEURS HYDROGENE-OXYDE D'ARGENT DESTINES A L'APPLICATION SPATIALE]

P. Jonville and F. Breda Oct. 1975 402 p refs In FRENCH

(Contract ESTEC-2296/74-HP)

(ESA-CR(P)-781) Avail: NTIS HC $11.00

To determine the applicability of the hydrogen/silver oxide system as electrical energy storage device for satellites and to investigate the problems involved when associating a metal oxide electrode to a gaseous diffusion electrode, the silver oxide/hydrogen couple performance was investigated. The operational mode of each constituent (hydrogen electrode, silver electrode) of the battery were studied, their characteristics evidenced and compared, and their compatibility analyzed. Performances and limitations of the hydrogen/silver oxide battery were assessed and compared to those of the H2/NiOOH. The electrolyte, the separator, the container and its configuration, seals, and some specific problems such as thermal transfer are also reviewed. ESA

N76-26703# Minnesota Univ., Minneapolis.

RESEARCH APPLIED TO SOLAR-THERMAL POWER SYSTEMS Semiannual Report, 1 Jan. - 31 Aug. 1975

E. M. Sparrow, B. P. Gupta, and G. K. Wehner Sep. 1975 167 p refs Prepared in cooperation with Honeywell, Inc., Minneapolis, Minn. Sponsored in part by ERDA

(Grant NSF GI-34871)

(PB-248811/2; NSF/RANN/SE/GI-34871/P4-75-2;

NSF/RA/N-75-219; SAR-6) Avail: NTIS HC $6.75 CSCL 10B

This project undertakes an integrated program of research and development focused on key technology of photothermal conversion for efficient use of solar energy in large-scale production of electricity. The report includes research and development on components of the system and heat transfer studies on system components. Experiments were continued on the scale model of a parabolic trough solar collector at a desert test site. A heat pipe with selective coating was replaced by a heat pipe coated with a flat black coating. Tests were performed with this absorber tube operating at temperatures up to 300 C. The effect of filling the space around the absorber tube with air was also studied. GRA

N76-26704# Ebasco Services, Inc., New York.
FOSSIL AND NUCLEAR 1000 MW CENTRAL STATION POWER PLANTS INVESTMENT ESTIMATES Final Report
Sep. 1975 24 p Sponsored by Elec. Power Res. Inst., Palo Alto, Calif.
(PB-248329/5; EPRI/IPS-75-601) Avail: NTIS HC $3.50 CSCL 18E

Estimates excluding escalation and interest during construction are provided on a consistent basis for two fossil-fuel-fired steam electric power generating plants (coal and oil) and a nuclear electric power generating plant (nuclear light water reactor plant), each plant consisting of a single unit having a maximum net output of 1000 MWe. The estimates were prepared on the basis of Ebasco's data and experience on other projects and are based on equivalent assumptions relative to site, labor performance and reference dates for cost data. The estimates are also based on average U.S. labor rates and productivity. Adjustment factors are included for labor rates and productivity for various areas of the continental U.S. GRA

N76-26705# Mobil Tyco Solar Energy Corp., Waltham, Mass.
SCALE-UP OF PROGRAM ON CONTINUOUS SILICON SOLAR CELLS Final Report, 1 May 1974 - 31 Jul. 1975
A. D. Morrison Sep. 1975 128 p refs
(Grant NSF AER-74-13081)
(PB-248963/1; NSF/RANN/AER74-13081/FR-75-2; NSF/RA/N-75-210) Avail: NTIS HC $6.00 CSCL 10B

A program to develop the technology of controlled continuous growth of silicon ribbon of solar cell quality is presented. The major steps accomplished revolved around the design of thermal and mechanical equipment and included the improvement and scale-up of an existent RF induction heated crystal growth system and the design, construction, and operation of a resistance heated continuous crystal pulling machine. This machine development program has also included modifications and improvements to growth setups, guidance systems, seed holders, temperature control equipment, and dies. GRA

N76-26706# Oregon State Univ., Corvallis. Engineering Experiment Station.
FUTURE DEVELOPMENTS IN WASTE HEAT UTILIZATION
James G. Knudsen and Larry L. Boersma Aug. 1975 117 p refs Workshop held at Portland, Oreg., 16-17 Dec. 1974
(Grant NSF ENG-75-03338)
(PB-249346/8; OSU-EES-75-49C) Avail: NTIS HC $5.50 CSCL 10A

The discussions and recommendations are summarized of a two-day industry-university-government conference on waste heat utilization. Topic areas discussed include: future developments in waste heat utilization; constraints on efficient waste heat utilization; general problems in reject heat utilization; the agro-power-waste water complex; energy utilization in agriculture; using power plant discharge water in greenhouse vegetable production; use of waste heat for soil warming and frost protection of field crops in northern climates; beneficial uses of waste heat from power plants for aquaculture; biological recycling of nutrients from livestock wastes; and utilization of warm water for afforestation of the Snake River desert plain. GRA

N76-26707# Science Applications, Inc., McLean, Va.
BENEFIT-COST METHODOLOGY FOR EVALUATING ENERGY CONSERVATION PROGRAMS
Robert Lind and Robert Nathans Dec. 1975 107 p refs
(Contract FEA-CO-04-50120-00)
(PB-249342/7; SAI-75-523-WA; FEA/D-76/011) Avail: NTIS HC $5.50 CSCL 10A

The basic concepts of benefit-cost analysis for conservation, and specific procedures for computing conservation benefits under different economic conditions are developed. This methodology is discussed as it applies to two major conservation options, the auto efficiency standard and home insulation. Using existing data, preliminary benefit-cost estimates are developed, and data requirements for improved estimation are discussed. GRA

N76-26708# Stanford Univ., Calif. High Temperature Gasdynamics Lab.
ATMOSPHERIC POLLUTION ASPECTS OF MAGNETOHYDRODYNAMIC POWER PLANTS Final Report
R. H. Eustis and C. H. Kruger Nov. 1975 20 p Sponsored by Elec. Power Inst.
(PB-248331/1; SU EPRI-110-FR) Avail: NTIS HC $3.50 CSCL 10B

Research is described on the economics and emissions of nitric oxide of projected magnetohydrodynamic power plants. The research consisted of two parts, a system study and laboratory measurements. The systems study addressed the question of capital and operating cost of a coal burning MHD and the possibility of controlling potentially excessive emissions of nitric oxide. The systems study concluded that a MHD cycle has the potential for reduced operating costs in comparison with the conventional plant, and that nitric oxide emissions may be controlled by means of two-stage combustion. The laboratory measurements provided values for the dominant rates of NO decomposition in the temperature range of interest. These rates were incorporated in the analysis of the systems study. GRA

N76-26709# Texas Univ., Arlington. Inst. of Urban Studies.
A SECOND REPORT TO TEXAS CITIES CONCERNING ENERGY AND LOCAL GOVERNMENT, EXAMINING THE PRICE OF CRISIS: POLICY DEVELOPMENT FISCAL IMPACT
David W. MacKenna, Jacilyn Walker, and P. D. Creer, Jr. Jul. 1975 144 p refs
(PB-248849/2) Avail: NTIS HC $6.00 CSCL 10A

A number of policy statements and legislative proposals at national as well as state levels are examined. Policy implications are suggested for the state of Texas with particular emphasis on local government. A process whereby city officials can contrast local energy costs with mean figures representing energy product expenses in the sample cities is discussed. GRA

N76-26710# Ultrasystems, Inc., Newport Beach, Calif.
A MARKET STUDY OF ENERGY-RELATED EQUIPMENTS FOR THE COMMERCIAL BUILDINGS SECTOR: DECISION-MAKERS, BUYING PROCESS, AND MARKETING STRATEGIES Final Report
19 Sep. 1975 155 p refs Sponsored by FEA
(Contract FEA-C-04-50202-00)
(PB-248618/1; FEA/D-76/010) Avail: NTIS HC $6.75 CSCL 13A

Detailed information is provided about the market for conservation particles in the commercial buildings sector that may be stimulated or supported by federal government actions and initiatives. The commercial building sector, both existing and projected through 1980, is described, and levels of energy consumption in each segment of the commercial buildings sector are listed. Key decision-makers involved in the buying and adoption process used for energy-related equipment, both new and retrofit are discussed. Existing market approaches, decision processes, areas of concentration for energy conservation, and recommendations for federal strategies to encourage energy conservation practices are covered. GRA

N76-26711# Dartmouth Coll., Hanover, N.H. Thayer School of Engineering.
MANAGING THE DISCOVERY LIFE CYCLE OF A FINITE RESOURCE: A CASE STUDY OF THE US NATURAL GAS INDUSTRY M.S. Thesis
Roger F. Naill Jun. 1972 146 p refs
(PB-248924/3; DSD-2; Dart-5) Avail: NTIS HC $6.00 CSCL 05C

A system dynamics model of discovery of U.S. natural gas is developed as an example of the dynamics of the natural resource discovery process. It is indicated that in the case of finite, nonrenewable resources such as the fossil fuels, the normal behavior mode of the exploitation system is an initial period of exponential growth in consumption, then a period of rising prices where growth in consumption is halted, and finally a decline in consumption. The exact timing of the end of growth is determined by many factors, including the growth rate of potential usage, the initial level of unproven reserves, the shape of the cost-of-exploration curve, and the impact of various policies such as subsidies or ceiling price regulations. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N76-26712 Texas Univ., Dallas.
EVALUATION OF THE ELUTRIATE TEST AS A METHOD FOR ASSESSING THE POLLUTIONAL CHARACTERISTICS OF DREDGED SEDIMENT NUTRIENTS Ph.D. Thesis
Marvin Dennis Piwoni 1975 216 p
Avail: Univ. Microfilms Order No. 76-12564

Sediments are normally enriched in nutrients compared to the overlying water. Agitation of the sediment-water mixture in the elutriate test produced almost instantaneous release of readily available nutrient forms such as NH4(+). Nitrate concentrations generally decreased slightly as a result of the elutriate test while soluble ortho-P concentrations showed variable change apparently related to the sediment-water systems. A relationship between the sediment-water ratio in the elutriate test mixture and the release of nutrients existed only for NH4(+). Method of agitation proved to be important because of its effect on the redox conditions in the reaction flask during the test. To maintain some control over these conditions, compressed gas agitation, using either air or nitrogen, was incorporated into the test procedure. Release under anoxic conditions was greater for all parameters except nitrate. Dissert. Abstr.

N76-26713 California Univ., Davis.
ENVIRONMENTAL BEHAVIOR OF HYDROPHOBIC POLLUTANTS IN AQUEOUS SOLUTIONS Ph.D. Thesis
James Arthur Singmaster, III 1975 152 p
Avail: Univ. Microfilms Order No. 76-14237

The hydrophobic pollutants include aldrin, dieldrin, the p,p'-DDT group, hexachlorobenzene, 2,2',4,4'-tetrachlorobiphenyl (a PCB), 2,4,5-T, isooctyl ester and several phthalic acid esters (PAE's). The environmental behavior in aqueous solutions includes volatilization and photolysis and some adsorption-desorption and biolysis. As a first requirement, a pollutant's level in water can not exceed its solubility. Secondly, fortified water samples must be solvent-free, which is achieved by evaporating solvent containing pollutants before adding water. A standard extraction method using an environmental water sample fortified by this technique gave low recoveries; inclusion of the interface between solvent-water gives 90% recoveries. With these techniques and a method for measuring volatilized pollutants, half lives of several hydrophobic pollutants in solutions were determined under photolytic and volatilizing conditions. Solutions were made from hexane-extracted deionized water, San Francisco Bay water, and American and Sacramento River waters. In addition, a new method was found for determining solubility limits of hydrophobic compounds. Dissert. Abstr.

N76-26714# Committee on Public Works (U. S. Senate).
AUTOMOTIVE LEAD EMISSIONS, PART 1
Washington GPO 1974 609 p refs Hearings before Panel on Environmental Sci. and Technol. of Subcomm. on Environmental Pollution of Comm. on Public Works, 93d Congr., 2d Sess., 7-8 May 1974
(GPO-32-757) Avail: Subcomm. on Environmental Pollution

The health effects of lead and the extent to which lead emissions from automobiles have created a health problem are examined. Emphasis is placed on lead absorption in children exposed to lead contaminated dirt and dust resulting from proximity to smelters, industrial plants, or highways. J.M.S.

N76-26715# Committee on Public Works (U. S. Senate).
AUTOMOTIVE LEAD EMISSIONS, PART 2
Washington GPO 1974 1298 p refs Hearings before Panel on Environmental Sci. and Technol. of Subcomm. on Environmental Pollution of Comm. on Public Works, 93d Congr., 2d Sess., 7-8 May 1974
(GPO-32-758) Avail: Subcomm. on Environmental Pollution

The health effects of lead emissions from automobiles and the technology available for control of such emissions are reported. Policy options for reduction of health hazards resulting from combustion of leaded gasoline are presented. These options are then discussed by various interest groups, including: government agencies, lead and lead trap producers, independent scientists, public interest groups, refiners, state and city officials, and automobile manufacturers. A review of their comments is given. J.M.S.

N76-26716*# Kanner (Leo) Associates, Redwood City, Calif.
THE THERMAL RADIO EMISSION OF A CONTAMINATED SEA SURFACE
V. Yu. Rayzer, Ye. A. Sharkov, and V. S. Etkin Washington NASA May 1976 32 p refs Transl. into ENGLISH from the Russian Report Pr-237
(Contract NASw-2790)
(NASA-TT-F-17033; PR-237) Avail: NTIS HC $4.00 CSCL 13B

Calculations are made of the radiative characteristics of water-film structures based on the thickness of the contaminating film and its temperature for various dielectric parameters of the contaminants, with allowance made for the formation of water-oil emulsions. Questions on the effective estimation of the thickness and dielectric parameters of films with the aid of remote UHF passive measurements of contaminated sea-surface areas are discussed. Calculations are compared with data from model experiments. Author

N76-26717*# Pittsburgh Univ., Pa. Chemical and Petroleum Engineering Dept.
THE DEVELOPMENT OF SENSORS AND TECHNIQUES FOR IN SITU WATER QUALITY MONITORING Annual Report, 13 Jun. 1975 - 12 Jun. 1976
Chung-Chiun Liu 12 Jun. 1976 42 p refs
(Grant NsG-3002)
(NASA-CR-148189) Avail: NTIS HC $4.00 CSCL 13B

Enzyme electrodes and chloride ion electrodes were investigated for in situ monitoring of water quality. Preliminary results show that miniature chloride ion electrodes and a phenol sensor are most promising in determining trace contaminants in water. B.B.

N76-26718*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A FOUR-CHANNEL PORTABLE SOLAR RADIOMETER FOR MEASURING PARTICULATE AND/OR AEROSOL OPACITY AND CONCENTRATION OF NO2 AND SO2 IN STACK PLUMES
Reginald J. Exton and Ray W. Gregory Washington Jun. 1976 17 p refs
(NASA-TN-D-8182; L-10608) Avail: NTIS HC $3.50 CSCL 13B

Solar absorption radiometry has been investigated as a method of measuring stackplume effluents. A simple and inexpensive instrument was constructed for observing the sun at four wavelengths: 800, 600, 400, and 310 nm. Higher wavelength channels measured the effect of the particulates and NO2, and an ultraviolet channel measured the contribution of SO2 to the attenuation. Stack-plume measurements of opacity and concentration of NO2 and SO2 were in basic agreement with in-stack measurements. The major limitation on the use of the radiometer is the requirement for an accessible viewing position which allows the sun-plume-observer relationship to be attained. It was concluded that the solar radiometer offers an inexpensive method for monitoring plume effluents when the viewing position is not restricted. Author

N76-26719# California Univ., Livermore. Lawrence Livermore Lab.
METHODOLOGY FOR IMPACT ASSESSMENT IN THE ESTUARINE/MARINE ENVIRONMENT

K. F. Haven 31 Oct. 1975 45 p refs
(Contract W-7405-eng-48)
(UCRL-51949) Avail: NTIS HC $4.00

Impacts on the estuarine/marine environment can be assessed in economic terms by tracing the impact flow out of the economic sector through the marine environment and back into the economic sector as changes in natural resource availability. An impact can then be measured by the changes created in the economic sector by changes in resource availability. Primary emphasis is placed on the development of an appropriate ecological model of the estuarine environment for this purpose. Two types, an ecological input/output model and a dynamic (difference equation) model, are proposed. Acceptability criteria for these models include the ability to track lethal and sublethal, direct and indirect (food web), and short and long term effects of a variety of pollutants related to the production and use of various energy resources.
Author (NSA)

N76-26720# California Univ., Livermore. Lawrence Livermore Lab.
ARAC SYSTEM
M. F. Kelly and R. H. Wyman 10 Dec. 1975 5 p Presented at the 9th Hawaii Intern. Conf. on System Sciences, Honolulu, Hawaii, 6 Jan. 1976
(Contract W-7504-eng-48)
(UCRL-77572; Conf-760105-1) Avail: NTIS HC $3.50

In spite of the remarkable safety record of the nuclear industry as a whole, recent public concern over the potential impact of the industry's accelerated growth has prompted ERDA to expand its emergency response procedures. The Atmospheric Release Advisory Capability, ARAC, is a computer communications system designed to enhance the existing emergency response capability of ERDA nuclear facilities. ARAC will add at least two new functions to this capability: centralized, real-time data acquisition and storage, and simulation of the long range atmospheric transport of hazardous materials. To perform these functions, ARAC employs four major sub-systems or facilities: the site facility, the central facility, the global weather center and the regional model.
Author (NSA)

N76-26721# Battelle Pacific Northwest Labs., Richland, Wash.
POLLUTANT TRANSFORMATIONS IN URBAN PLUMES
A. J. Alkezweeny 1975 3 p Presented at the Eighth Aerosol Technol. Meeting, Research Triangle Park, N. C., 6 Oct. 1975
(Contract E(45-1)-1830)
(BNWL-SA-5551; Conf-751050-1) Avail: NTIS HC $4.50

The aircraft was instrumented for the purpose of measuring the following: aerosol particle size distribution in the range of 0.01 micrometers to 5.0 micrometers, concentrations of Aitken particles, O3, NO, NO2 and SO2, hydrocarbons, trace metals, and sulfate. A comprehensive diagnostic model of multicomponent advection, diffusion, and transformation was completed. In the absence of pollutant entrainment the concentrations of the total particles, in particular those of a diameter less than 0.06 micrometers and particles larger than 1 microns, decreased in time. However, the concentrations of aerosol particles in the range of 0.06 0.9 micrometers increased. The total volume concentration of particles up to 2 micrometers in diameter also increased with time.
ERA

N76-26722# Los Alamos Scientific Lab., N.Mex.
DEVELOPMENT OF AIR-SAMPLING TECHNIQUES: LASL PROJECT R-059, NIOSH-1A-74-10 Progress Report, 1 Oct. 1974 - 31 Mar. 1975
E. E. Campbell, G. O. Wood, and R. G. Anderson Sep. 1975 18 p refs
(Contract W-7405-eng-36)
(LA-6057-PR) Avail: NTIS HC $3.50

A silica gel tube for sampling aliphatic amines in air has been proposed based on experimental studies. Sampling methods and analytical procedures using this tube also are described. Total retention on the tube during sampling of methylamine, ethylamine, dimethylamine, isopropylamine, butylamine, diethylamine, triethylamine, and diisopropylamine can be achieved even at extreme concentration and humidity conditions. Complete removal from silica gel for analysis has been demonstrated for all but the latter two amines, for which desorption by sulfuric acid can be made greater than 80 percent. Sensitivity of the proposed gas chromatographic analytical method also has been measured. An air sampling and analysis method of hydrazine, methylhydrazine, and 1,1-dimethylhydrazine has been developed. A sampling tube containing sulfuric acid-coated silica gel is proposed. Complete retention of hydrazines on this sorbent during sampling and complete elution by distilled water has been demonstrated.
ERA

N76-26723# Kiel Univ. (West Germany). Inst. fuer Meereskunde.
STUDIES OF WATER EXCHANGE IN KIEL BIGHT Final Report
Wolfgang Lange, Thomas Mueller, Heinrich Raethjen, and Gerold Siedler Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 74 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-75-06) Avail: NTIS HC $4.50; ZLDI, Munich DM 15,60

Results of physical measurements obtained in 1972 in the Fehmarn Belt and from 1971 to 1973 in the Flensburg Fjord are presented. The investigations were aimed at studying the causes and development of water exchange processes in order to obtain a basis for models describing the spreading of pollutants in Kiel Bight. It is shown that the horizontal transport fluctuations in the surface layer of the Fehmarn Belt are caused mainly by wind stress over the Arkona Basin. Potential methods for predicting transport variations in the Fehmarn Belt from meteorological observations are indicated. First results from the Flensburg Fjord display the strong dependence of inflow and outflow on the local wind field.
Author (ESA)

N76-26724# Kiel Univ. (West Germany). Inst. fuer Meereskunde.
ACUTE TOXICITY OF CRUDE OIL TO FISH FRY AND THE INTAKE OF SUBLETHAL CONCENTRATIONS OF CRUDE OIL HYDROCARBONS BY THE FISH ORGANISM Final Report
Walther Werner Kuehnhold Bonn Bundesmin. fuer Forsch. u. Technol. Nov. 1975 33 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. fuer Forsch. u. Technol.
(BMFT-FB-M-75-07) Avail: NTIS HC $4.00; ZLDI, Munich DM 6,95

The lethal concentrations of the seawater soluble fractions of three crude oils for eggs of cod and larvae of cod and herring were investigated. Aftereffects of short time influence, retardation of development, and embryonic deformations were observed. The narcotic effect of crude oil is only partly reversible. The toxicity of an emulsified crude oil increases with time when using a (non-toxic) emulsifier, in contrast to emulsification without addition. The possibility of mortality of eggs and larvae by oil at sea was considered, taking into account several hydrographical and biological factors. The problems of laboratory tests with fish fry and the difficulties in handling seawater-crude oil-mixtures as test media are discussed. The basic conditions of the continuing program on the accumulation of hydrocarbons of crude oils at sublethal concentrations are explained.
Author (ESA)

N76-26725# Colorado Univ., Boulder. Dept. of Civil and Environmental Engineering.
RESEARCH NEEDS FOR THE POTABLE REUSE OF MUNICIPAL WASTEWATER Final Report, Dec. 1974 - Oct. 1975
K. Daniel Linstedt, ed. and Edwin R. Bennett, ed. Dec. 1975 203 p refs Workshop held at Boulder, Colo., 17-20 Mar., 1975
(Grant EPA-R-803546)
(PB-249138/9; EPA-600/9-75-007) Avail: NTIS HC $7.75 CSCL 13B

The objective of the workshop was to define and establish priorities for research needed to develop confidence in the reuse of wastewater for potable purposes. This objective was accomplished by bringing together 92 select persons concerned with wastewater reuse to discuss and identify research gaps in the areas of health effects, treatment technology, and the socio-economic considerations of potable reuse.
GRA

N76-26726# Maryland Univ., College Park. Dept. of Microbiology.
METABOLISM OF MERCURY COMPOUNDS IN MICROORGANISMS Ecological Research Series.
Rita R. Colwell Oct. 1975 94 p refs
(Grant EPA-R-802529)
(PB-249000/1; EPA-600/3-75-007) Avail: NTIS HC $5.00 CSCL 06M

The report describes the physiology and ecology of mercury-resistant and mercury-metabolizing bacteria from Chesapeake Bay. Evidence is presented which establishes a role for bacteria in the cycling of mercury in the estuarine environment. From the results of a survey of elemental mercury production among a group of randomly selected, HgCl2-resistant bacteria and mixed natural microbial populations, it was established that the enumeration of mercury-resistant bacteria by plate counting is a valid index of potential Hg(+2) metabolism in situ. The distribution of mercury-resistant bacteria was significantly different in water and sediment, from station to station, and seasonally. The proportion of Hg(+2) resistant bacteria among the total, viable, heterotrophic bacterial population reached a reproducible maximum in spring and was positively correlated with water turbidity, dissolved oxygen concentration, and mercury concentration in the sediment. These findings suggest that bacteria may contribute substantially to the mobilization and transformation of mercury from existing deposits in Chesapeake Bay. GRA

N76-26727# North Carolina State Univ., Raleigh. Dept. of Microbiology.
ROLE OF MICROORGANISMS IN THE DECOMPOSITION OF DEEP WELL INJECTED LIQUID INDUSTRIAL WASTES Interim Progress Report, 1 Jul. 1974 - 30 Jun. 1975
Gerald H. Elkan 1975 50 p refs
(Grant NSF GI-39586)
(PB-249056/3; NSF/RA/E-75-059) Avail: NTIS HC $4.00 CSCL 06M

Growing organisms isolated from deep aquifers and identifying the native microflora for introduction into model aquifer systems were investigated along with the design and operation of model aquifers simulating as closely as possible the natural injection zones used. The bacterial flora of three saline aquifers was examined. Aerobic, anaerobic, and facultative microorganisms were isolated and classified to genus. Long term batch fermentations of industrial wastes were carried out using a mixed inoculum obtained from unpolluted aquifers. Model aquifer systems were designed which incorporated the major actual elements of native aquifers. GRA

N76-26728# Water Resources Engineers, Inc., Walnut Creek, Calif.
FUTURE DIRECTION OF URBAN WATER MODELS Final Report
Michael B. Sonnen, Larry A. Roesner, and Robert P. Shubinski Feb. 1976 95 p refs
(Contract EPA-68-03-0499)
(PB-249049/8; WRE-12490; EPA-600/2-76-058) Avail: NTIS HC $5.00 CSCL 13B

The state-of-the-art of urban water modeling since 1968 is reviewed. Urban water subsystems addressed are: rainfall, runoff, and snowmelt; urban watersheds; water supply; water distribution facilities; water use; waste collection and conveyance; waste treatment; receiving waters; and water reuse. Future urban water models were suggested from (1) the review and, (2) demonstrated needs for additional problem solving capabilities. A phased model implementation program for the EPA's storm and combined sewer section was suggested. GRA

N76-26729# Minnesota Univ., Minneapolis. Water Resources Research Center.
STUDIES ON THE EFFECTS OF THERMAL ADDITIONS ON SELECTED ZOOPLANKTON POPULATIONS
Wayland R. Swain, Robert M. Wilson, and R. Peter Neri Nov. 1975 96 p refs
(PB-249497/9; WRRC-Bull-84; W76-04012; OWRT-B-097-Minn) Avail: NTIS HC $5.00 CSCL 06F

The objective was to examine the effects of calefaction upon members of the animal portion of the Lake Superior ecosystem. Additionally, certain species which are widely available were also utilized in order to establish a point of reference which could be used by workers in other parts of the country. The method described here utilized the establishment of an artificial segment of Lake Superior in a carefully controlled laboratory setting which could be modified at will in order to observe the impacts of each change upon the test organism or community. Critical to this study was a method of observation of organism behavior which allowed remote monitoring of the population, but did not alter the environment of the test animals. GRA

N76-26730# Environmental Protection Agency, Athens, Ga.
DYNAMIC BEHAVIOR OF VINYL CHLORIDE IN AQUATIC ECOSYSTEMS
James Hill, IV, Heinz P. Kollig, Doris F. Paris, N. Lee Wolfe, and Richard G. Zepp Jan. 1976 74 p refs
(PB-249302/1; EPA-600/3-76-001) Avail: NTIS HC $4.50 CSCL 06F

To evaluate the behavior of vinyl chloride in aquatic ecosystems, best estimate and worst case models of lake and stream ecosystems were analyzed through the use of mathematical simulation. The characteristics of the chemical, biological, and physical transformations of vinyl chloride indicated in the models were determined by laboratory experimentation and extrapolation of reaction data for similar compounds. These transformations included oxidation, substitution, elmination, hydrolysis, and free radical reactions; complexation; direct and indirect photochemical reactions; microbial degradation and toxicity; bacterial, algal, and fungal sorption; and volatilization. GRA

N76-26731# Harvard School of Public Health, Boston, Mass.
HIGH-VELOCITY, HIGH-EFFICIENCY AEROSOL FILTRATION Final Report, Apr. 1973 - Apr. 1975
David Leith, Stephen N. Rudnick, and Melvin W. First Jan. 1976 188 p refs
(Grant EPA-R801399-02)
(PB-249457/3; EPA-600/2-76-020) Avail: NTIS HC $7.50 CSCL 13B

The dust collection characteristics of fabric filters were studied. Techniques for measuring dust deposit porosity as a function of cloth characteristics and filtration velocity on a bench-scale filter are described. A method for impregnating and slicing the dust deposit for examination under the electron microscope is also described. For the pulsejet pilot-scale filter flyash penetration decreased as the dust deposit thickened, increased with increasing filtration velocity, and remained relatively constant for particles down to 0.30 micrometers diameter. Dust emission mechanisms were investigated using chemically tagged flyash. Penetration by straight-through dust loss falls off rapidly after cleaning, but later increases. Seepage through the fabric was constant throughout the filtration cycle. Dust lost as pinhole plugs increased after cleaning, but later declined; however, the pinholes may open the way for further emission by the straight-through mechanism. Fabric cleaning was a problem during high velocity operation. GRA

N76-26732# Stanford Research Inst., Menlo Park, Calif. Atmospheric Sciences Lab.
DEVELOPMENT OF AN ACOUSTIC SOUNDER NETWORK FOR AIR POLLUTION AND LAND USE APPLICATIONS Progress Report
Phillip B. Russell and Edward E. Uthe Aug. 1975 49 p refs Presented at the Workshop in Atmospheric Acoustics, 3rd, Toronto, Ont., 24-27 Jun. 1975
(Grants NSF GL-43498; NSF AEN-73-02918-A01)
(PB-249082/9; NSF/RA/E-75-058; PR-2) Avail: NTIS HC $4.00 CSCL 13B

To investigate the usefulness of acoustic sounder information to air pollution studies in the San Francisco Bay Area, simultaneous measurements with a collocated lidar (laser radar) and acoustic sounder were made at two neighboring Bay Area sites. A wide variety of diurnal patterns in acoustic sounder data was observed. To assess the relationship between this sounder information and air pollution, a classification scheme was developed whereby each observation day was classified as having one of six different types of sounder record pattern. It was found that periods of near-surface atmospheric stability were accompanied by lower concentrations of near-surface pollution. GRA

N76-26733# Clow Corp., Florence, Ky.
ULTRAVIOLET DISINFECTION OF ACTIVATED SLUDGE EFFLUENT DISCHARGING TO SHELLFISH WATERS Final Report, 1968 - 1972
J. A. Roeber and F. M. Hoot Dec. 1975 96 p refs Sponsored in part by the town of Saint Michels, Md.
(Grant EPA-WPRD-139-01-68)
(PB-249460/7) Avail: NTIS HC $5.00 CSCL 13B

A tertiary treatment plant and an ultraviolet disinfection chamber were installed following an activated sludge plant at the municipal sewage treatment plant in St. Michaels, Maryland. The multiple-tube fermentation technique was used to determine the total coliform MPN Index after varying exposures to ultraviolet radiation. Batch tests were sampled at various intervals under constant radiation and flow-through tests were sampled before and after undergoing radiation. The absorption of ultraviolet radiation, as measured by the absorption coefficient, was much more dependent on COD than on turbidity, indicating the appearance of the effluent is not the best criterion for estimating the rate of U.V. treatment unit. GRA

N76-26734# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
AIR POLLUTION: FIRST FOLLOW-UP REPORT. AIR POLLUTION PILOT STUDY
Sep. 1975 43 p
(PB-249527/3; NATO/CCMS-41) Avail: NTIS HC $4.00 CSCL 13B

General assessments of air pollution, standard-setting, establishment of air quality monitoring systems and suitable systems for retrieval and storage of data, employment of recognized reference methods for monitoring, and institution of uniform procedures for conducting emissions inventories are described. GRA

N76-26735# Minnesota Univ., Minneapolis. Particle Technology Lab.
FINE PARTICLES
Benjamin Y. H. Liu Oct. 1975 803 p refs Symp. held at Minneapolis, Minn., 28-30 May, 1975
(Contract EPA-R-803556-01)
(PB-249514/1; EPA-600/2-75-059) Avail: NTIS HC $21.25 CSCL 13B

The purpose of the symposium was to review the state of the art and recent developments in instrumentation and experimental techniques for aerosol studies. The focus was on fine particles below about 3.5 micrometers in diameter. Topics covered include aerosol generation, measurement, sampling, and analysis. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N76-26736 Columbia Univ., New York.
PREMONITORY CHANGES IN SEISMIC VELOCITIES, OBSERVATIONS, CAUSAL MECHANISMS AND APPLICATION TO EARTHQUAKE PREDICTION Ph.D. Thesis
Yash Pal Aggarwal 1975 65 p
Avail: Univ. Microfilms Order No. 76-13121

The nature and causes of certain phenomena precursory to earthquakes in an effort to develop a unified approach to the earthquake prediction problem was determined. The occurrence and recording of an earthquake swarm at Blue Mountain Lake, New York, in May-August 1971 provided an unusual opportunity to study earthquake processes at close range. The near total absence of sedimentary cover, accessibility of the epicentral area (2 x 2 km), the shallow focal depths, allowed excellent recordings of both P and S phases at short distances. Most of the events occurred on a well defined, easterly dipping thrust fault of relatively narrow thickness (0.2 km). The data revealed the occurrence of premonitory changes in the travel-time ratio of S to P waves, preceding all the larger events (mb = 2.5 to 3.3) in the swarm. Typically t sub s/t sub p at first decreased and subsequently returned to normal prior to the earthquake. Dissert. Abstr.

N76-26737 Colorado State Univ., Fort Collins.
ATMOSPHERIC EDDY TRANSPORTS AND THEIR EFFICIENCIES Ph.D. Thesis
Srinivasan Srivatsangam 1975 98 p
Avail: Univ. Microfilms Order No. 76-13665

Zonal harmonic analysis of large-scale atmospheric eddies yields the following information on horizontal and vertical transport processes: (1) wave-numbers 1 and 2 outweigh the other harmonics in the equatorward and up-gradient transfer of sensible heat by the standing eddies in the lower atmosphere of the Arctic region in January 1970, (2) the negative viscosity of the large-scale eddies, i.e., the up-gradient transfer of momentum by these eddies, is dependent upon the north-south transport of sensible heat, (3) only fractions of the zonal variances of virtual temperature and zonal momentum are available for meridional transport (in all Rossby regimes), and (4) a rigorous discussion of vertical transports is set forth through a diabatic thermodynamic equation, with the result that all of the variances of sensible heat, water vapor and zonal momentum are useful in vertical transfer processes. Dissert. Abstr.

N76-26738 California Univ., San Diego.
LARGE SCALE AIR-SEA INTERACTIONS WITH A SIMPLE GENERAL CIRCULATION MODEL AND THE EQUILIBRIUM STATISTICAL MECHANICS OF QUASI-GEOSTROPHIC FLOWS Ph.D. Thesis
Richard Lawrence Salmon 1976 117 p
Avail: Univ. Microfilms Order No. 76-12869

Lorenz's two-layer atmospheric model is coupled to a copper plate ocean to obtain a simple model that can be used to study the effects of large scale sea surface temperature anomalies on the dynamics of the atmosphere. The results suggest that the response may be small compared to random differences that occur in an averaging time as short as one year. The principles of classical equilibrium statistical mechanics are used to derive the equilibrium states toward which spectrally truncated representations of the equations of motion would evolve in the absence of forcing and viscosity. In the case of two immiscible layers, the internal radius of deformation constitutes an important dividing scale: At scales of motion larger than the radius of deformation, the equilibrium flow is nearly barotropic while at smaller scales the streamfunctions in the two layers are statistically uncorelated. Dissert. Abstr.

N76-26739 Texas A&M Univ., College Station.
SOME GEOPHYSICAL IMPLICATIONS OF PHASE TRANSITIONS INSIDE THE EARTH Ph.D. Thesis
Jean-Claude Mareschal 1975 259 p
Avail: Univ. Microfiims Order No. 76-12679

The motion of a phase boundary inside the earth, caused by the application of pressure and temperature perturbations at the surface, is determined under a linear approximation. The Laplace transform is used to determine the Green's function for the phase boundary motion. The inversion of the Laplace transform can be performed by a term by term inversion of its series expansion, or by integration along a branch cut. This former method yields simple analytical expressions that are applicable to many geophysical problems. The results show that the amplitude of the phase boundary motion is inversely proportional to the difference in slope between the Clausius-Clapeyron equation and the geotherm. A numerical solution to the Stefan problem is used to determine the motion of the earth's surface due to a phase transition. A two dimensional model is used to determine the equilibrium position of a phase boundary when a horizontally varying load is applied at the earth's surface. Dissert. Abstr.

N76-26740 Texas A&M Univ., College Station.
SOME PROBLEMS ASSOCIATED WITH THE INVERSION OF POLAR MAGNETIC SUBSTORM DATA RECORDED AT THE EARTH'S SURFACE Ph.D. Thesis
Marianne Mareschal 1975 204 p
Avail: Univ. Microfilms Order No. 76-12680

An original method for resolving the current system associated with polar magnetic substorms from ground based magnetic observations, based on a general technique of inversion was

tested. Before attempting the inversion of actual polar magnetic substorm data, the problems arising from the fact that the earth is an electrical conductor which modifies the ground based magnetic signature of any external current system was investigated. Conclusions were shown to remain valid for a three dimensional source as long as the magnetic data were roughly recorded along the central meridian of the system. Inverting polar magnetic substorm data with the use of the three dimensional model of current, the earth's induction effects can be simulated by introducing a perfectly conducting layer inside the earth.
Dissert. Abstr.

N76-26741*# Transemantics, Inc., Washington, D.C.
MATERIAL OF STUDIES OF MESOSPHERIC CLOUDS
O. B. Vasilyev, ed. NASA Oct. 1975 112 p Transl. into ENGLISH of the book "Materialy Issledovaniya Mezosfernykh Oblakov: Prilozheniye k Sbornik, Fizika Mezosfery i Mezosfernykh Oblakov, Meteorologicheskiye Issledovaniya, no. 22" Moscow, Nauka Press, 1975 p 3-112
(Contract NASw-2792)
(NASA-TT-F-16610) Avail: NTIS HC $5.50 CSCL 03A

Results are given of a calculation of the characteristics of a radiation field with scattered noctilucent clouds (indicatrices of scattering and the degree of polarization) for various ensembles of particles at scattering angles of from 6 to 90 degrees as well as the spectral brightness of noctilucent clouds. These results were not included in the aforementioned collection. Computed values of the components of the scattering matrix for certain optical models of mesospheric aerosol are also given.
Author

N76-26742*# Transemantics, Inc., Washington, D.C.
PHYSICS OF THE MESOSPHERE AND MESOSPHERIC CLOUDS. METEOROLOGICAL STUDIES, NO. 22
O. B. Vasilyev, ed. NASA Mar. 1976 209 p refs Transl. into ENGLISH of "Fizika Mezosfery i Mezosfernykh Oblakov. Meteorologicheskiye Issledovaniya, no. 22" Moscow, Nauka Press, 1975 p 1-152
(Contract NASw-2792)
(NASA-TT-F-16611) Avail: NTIS HC $7.75 CSCL 03A

Articles dealing with the study of the structure and composition of the mesosphere and mesospheric clouds were presented. Possible aeronomical reactions in the zone of mesospheric clouds are discussed; data on the structure and nature of aerosols in high layers of the atmosphere are presented; overall evaluations of the moisture content in the stratosphere and mesosphere are made; and a possible connection between mesospheric clouds and meteor phenomena in the earth's atmosphere is studied.
Author

N76-26743*# Scientific Translation Service, Santa Barbara, Calif.
THE INFLUENCE OF NUISANCE PARAMETERS ON THE SOLUTION OF THE PROBLEM OF SIMULTANEOUSLY DETERMINING THE SHAPE AND EXTERNAL GRAVITATIONAL FIELD OF THE EARTH
P. Ye. Elyasberg Washington NASA Jun. 1976 16 p refs Transl. into ENGLISH of "Vliyaniye Meshayushchikh Parametrov na Resheniye Zadachi Sovmestnogo Opredeleniya Figury i Vneshnego Gravitatsionnogo Polya Zemli", Rept. D-221 Inst. of Space Res., Acad. of Sci. USSR, Moscow, 1975 p 1-15
(Contract NASw-2791)
(NASA-TT-F-17034; D-221) Avail: NTIS HC $3.50 CSCL 08E

The influence of nuisance parameters on the problem of simultaneous determination of the earth's shape and external gravitational field and on the determination of the segments of satellites' orbits is studied. It is assumed that nuisance parameters are various implicit factors, such as senior components of earth's gravitational potential, errors of geodesic linking between satellite monitoring ground stations, etc. Nuisance parameters and their effect on the accuracy of the problem's solution, on the structure of the filtering algorithm, and the applicability of some other parameters which can either increase or decrease the accuracy of the solution are studied.
Author

N76-26744# Lockheed Missiles and Space Co., Palo Alto, Calif.
STRUCTURE OF AURORAL PROTON DUMPING
R. A. Kovrazhkin [1976] 10 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 14, no. 1, 1976 p 53-60
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The characteristics of dumped protons in the near-midnight in the auroral zone are considered by means of measurements on the Cosmos-348. Analysis of the results shows that a maximum of proton dumping with E sub p less than 6 keV mean energies is observed with an almost isotropic pitch-angle distribution near the equatorial boundary of the averaged zone of the H sub alpha hydrogen emission glow at a magnetically quiet time. The results obtained are interpreted on the basis of theoretical representations about plasma convection under the effect of an electrical field in the magnetosphere tail and about the formation of a neutral line with an X-type point during the substorm.
Author

N76-26745# Bureau of Mines, Denver, Colo. Mining Research Center.
MICROSEISMIC TECHNIQUES FOR MONITORING THE BEHAVIOR OF ROCK STRUCTURES
Wilson Blake, Fred Leighton, and Wilbur I. Duvall 1974 69 p refs
(BM-Bull-665) Avail: SOD HC $1.10 as I28.3:665

Results are presented of a 7-year Bureau of Mines program to review, revise and make an effective engineering tool of the microseismic method of determining the stability of rock structures. The program consisted of developing new microseismic equipment, data processing and data analysis techniques, and extensive field investigations to demonstrate the effectiveness and potential of the broad-band microseismic method. The guidelines for choosing the components of a microseismic system are presented along with approximate cost figures. Different microseismic systems are discussed, including completely automated systems. Procedures for conducting microseismic investigations and analyzing microseismic data are discussed in detail. Field situations which show the full value of the microseismic technique as an engineering tool are described. Mathematical solutions (least squares method, iteration) used in the data analysis of microseisms are outlined.
Author

N76-26746# Massachusetts Inst. of Tech., Cambridge.
SEISMOLOGICAL INVESTIGATION OF CRACK FORMATION IN HYDRAULIC ROCK FRACTURING EXPERIMENTS Progress Report, 1 Jan. - 31 Aug. 1975
K. Aki Sep. 1975 28 p refs
(Contract E(11-1)-2534)
(COO-2534-1) Avail: NTIS HC $5.00

A new seismic method of determining the location, size and orientation of hydrofractured cracks was developed. The method uses the active devices such as explosion and vibroseis. The effect of heterogeneous earth medium on the seismogram is eliminated by taking the difference between two seismograms obtained in repeated experiments; one before and the other after the crack formation. Since the crack will act as a virtual seismic source for the differential seismograms at far-field, the conventional technique used for earthquake source mechanism studies is applied to find the location, size, and orientation of the crack. The differential seismogram at near field will define the shadow zone which can be used most effectively for the determination of crack location. A computer program was developed to calculate the seismic wave scattering by a crack for the case of incident P, SV, and SH waves.
ERA

N76-26747# Kiruna Geophysical Inst. (Sweden).
BUOYANCY WAVES IN THE SURFACE INVERSION DURING THE SUBARCTIC WINTER
Hans Westin Dec. 1975 36 p refs Sponsored by Swed. Nat. Sci. Res. Council
(KGI-Rept-75-2) Avail: NTIS HC $4.00

A microbarograph-array with low-frequency microphones was used to study buoyancy waves within the wintertime surface inversions at Kiruna, Sweden. The waves had characteristic periods of 1 to 1.5 minutes and a mean amplitude of 9 microbar. Wave velocities could be determined for a number of waves and a mean velocity of 8 m/s was found. Different types of inversions were compared with the buoyancy wave activity, and it was found that the wave activity was highest for strong inversions with small depths and with a sudden transition to an upper

layer with near adiabatic lapse rate. These waves were also of better quality. No buoyancy wave activity was observed during days with inversions with a low temperature difference, which gradually changed to an upper layer. The winds at the top of the inversions had the highest speeds during good buoyancy wave activity. Periods with no buoyancy waves had a significantly lower wind speed. The mean wave velocity agreed with the mean wind speed aloft. Buoyancy wave activity was highest during winds from NNE and from W. These wind directions were found to be associated with strong inversions. Observations were found to agree with an atmospheric model with two layers and with wind and density discontinuities. Author (ESA)

N76-26748# Danish Meteorological Inst., Copenhagen.
PRECIPITATION OF AURORAL PARTICLES IN THE CENTRAL POLAR CAP DURING A SUDDEN COMMENCEMENT MAGNETIC STORM
K. Lassen and G. Weill (Inst. d'Astrophys., Paris) 1975 35 p refs
(DMI-Geophys-Papers-R-44; ISBN-87-7478-113-8) Avail: NTIS HC $4.00

All-sky camera observations from two stations in the inner (northern) polar cap and an auroral zone station are combined with photometer records from the polar cap station Nord in a study of the brilliant auroral display following the Storm Sudden Commencement (SSC) of the storm of Nov. 7, 1970. The display is the large poleward expanding bulge of a substorm triggered by the SSC. It is composed of brilliant discrete forms embedded in low-intensity diffuse electron and proton aurora. The poleward edge of the diffuse electron aurora is 5 deg north of the discrete auroras and 3 deg north of the proton aurora. The intensity of the discrete aurora varies as the strength of the auroral electrojet as shown by magnetograms from auroral zone stations. Succeeding the retreating display a subvisible low-energetic electron precipitation, which may be identified as the polar squall, is observed over the polar cap during the main phase of the storm. In the early morning sector already existing diffuse auroras are broadening towards equator from the time of the SSC and at least during the following half hour. Author (ESA)

N76-26749# New York State Energy Research and Development Authority, New York.
IDENTIFICATION OF LATE QUATERNARY SEDIMENT DEFORMATION AND ITS RELATION TO SEISMICITY IN THE ST. LAWRENCE LOWLAND, NEW YORK
Sep. 1975 277 p refs Sponsored by New York State Energy Res. and Develop. Authority
(PB-248398/0; NYSERDA-75/14) Avail: NTIS HC $9.25 CSCL 08G

This report discusses Quaternary deformed sediments in the St. Lawrence Lowland of New York State. The principal objectives of the investigation were to identify late Quaternary deformational structures and to evaluate the relation of soft-sediment changes with possible seismic events. To accomplish these goals it was necessary to: (1) compile an extensive bibliography, (2) perform geological reconnaissance field work in a 2,500 sq mi area, and (3) undertake laboratory analyses of specimens and experiment studies. Examination was made of numerous field sites that contain deformed sediments and special attention has been placed on those structures that possess the greatest promise of being related to earthquake activity. GRA

N76-26750# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
COMPARISON OF THEORIES FOR INTENSITY FLUCTUATIONS IN STRONG TURBULENCE Physical Science Research Papers
Ronald L. Fante 26 Sep. 1975 18 p refs
(AF Proj. 2153)
(AD-A018863; AFCRL-PSRP-643) Avail: NTIS CSCL 04/1

Theories for the intensity scintillations of a wave propagating through a thin, highly turbulent layer have recently been developed by both the optical and radio-astronomy communities. It is demonstrated here that these results, which are at first glance dissimilar, are in fact identical. Author (GRA)

N76-26751# Colorado Univ., Boulder. Dept. of Astro-Geophysics.
THE GLOBAL DISTRIBUTION AND VARIATIONS OF ATMOSPHERIC OZONE Final Report
Julius London Jul. 1975 22 p Sponsored in part by NSF
(Contract DOT-AS-20091)
(AD-A019501; DOT-TST-76-12) Avail: NTIS CSCL 04/1

During the past three years there has been a national and international intensification of research programs to study the photochemical production and destruction of atmospheric ozone and its variations in a dynamic atmosphere. This intensified effort is in response to the realization that ozone, as a highly reactant gas, can be involved in a large number of chemical interactions with stratospheric trace substances (both 'natural' and 'artificially produced') to significantly vary its concentration in the stratosphere. Some important possible consequences of such interaction would be: (1) changes in solar ultraviolet radiation received at the ground with serious biospheric effects; (2) changes in the thermal and dynamic structure of the stratosphere with potential climatic implications. Two aspects of the so-called 'ozone problem' have been studied: (1) the analysis of the global distribution and variations of total ozone; (2) photochemistry of stratospheric ozone and its interaction with atmospheric circulation. This report describes the results of these studies. GRA

N76-26752# Digital Programming Services, Inc., Waltham, Mass.
DEVELOPMENT AND APPLICATION OF DATA PROCESSING TECHNIQUES AND ANALYTIC PROCEDURES TO CLOUD PHYSICS DATA Final Report, 1 Jul. 1974 - 30 Jun. 1975
Lawrence E. Belsky, Frederic B. Kaplan, and Paul M. Rodenhiser 28 Jul. 1975 163 p refs
(Contract F19628-75-C-0043; AF Proj. 627A)
(AD-A018662; AFCRL-TR-75-0427) Avail: NTIS CSCL 04/1

This report outlines the data reduction techniques used in processing the meteorological data collected by the airborne data collection system. The real time executive system for the on-board PDP 8E computer is also fully explained. (GRA)

N76-26753# General Electric Co., Santa Barbara, Calif.
REACTION RATE DATA, NUMBER 53
Sep. 1975 17 p refs
(Contract DNA001-75-C-0023)
(AD-A019095) Avail: NTIS CSCL 04/1

Summaries of research on atmospheric chemistry and physics are presented. Reaction kinetics, atomic and molecular physical processes and thermochemistry related to the upper atmosphere are included. GRA

N76-26754# HSS, Inc., Bedford, Mass.
AURORAL SPECTROGRAPH DATA REDUCTION SYSTEM Final Report, 1 Jul. 1973 - 30 Jun. 1975
Lawrence B. Woolaver 30 Jun. 1975 119 p refs
(Contract F19628-73-C-0299; AF Proj. 6690)
(AD-A019110; HSSB-014; AFCRL-TR-75-0360) Avail: NTIS CSCL 04/1

This report presents a data reduction system for use with photographic records produced by the Model 173 Auroral Spectrograph. The system includes the results of a spectral sensitometric study designed to overcome the variations in field processing of the data film. A computer program is presented which searches the data base for a selected set of spectral lines and computes the line radiance for these lines. GRA

N76-26755# Lockheed Missiles and Space Co., Palo Alto, Calif.
MAGNETOSPHERIC PARTICLES AND FIELDS Final Technical Report, Mar. - Dec. 1975
Billy M. McCormac Dec. 1975 28 p refs
(Contract N00014-75-M-0019)
(AD-A019041; LMSC-D464180) Avail: NTIS CSCL 04/1

The presentations and discussions of the Summer Advanced Study Institute, 'Magnetospheric Particles and Fields,' held at Graz, Austria, August 4-15, 1975, are summarized. Topics considered include the following: solar wind and magnetosheath; boundary and outer magnetosphere; plasma process in the inner magnetosphere; magnetosphere-ionosphere interactions; magnetospheres of other planets. GRA

N76-26756# North American Weather Consultants, Goleta, Calif.
SANTA BARBARA CONVECTIVE BAND SEEDING TEST PROGRAM Final Report, 1967 - 1974
John R. Thompson, Keith J. Brown, and Robert D. Elliott Oct. 1975 227 p refs
(Contract N00123-75-C-0047)
(AD-A018672; NWC-TP-5804) Avail: NTIS CSCL 04/1

Tests to determine the effectiveness of seeding convective portions of winter storm systems passing over Santa Barbara County were conducted from a 1,065-meter mountain ridge using a pyrotechnic fuse during four winter seasons from 1967-68 through 1970-71 (Phase I). After an experimental period in 1970-71, full scale Phase II aerial operations were continued through the 1973-74 seasons. Aerial seeding using an AgI-NH4I-acetone solution was conducted just west of Santa Barbara County with the nucleant being dispensed by a burner developed by the Naval Weapons Center. A limited amount of seeding was also conducted from the mountain ridge site utilizing a modified version of the Naval Weapons Center acetone burner. Organized areas of convection (convective bands) were identified and tracked through the project area by means of telemetered raingages and radar. In both phases, the program was randomized with approximately one half of the convection bands being seeded. However, the randomization scheme in Phase II was revised so that all the convection bands which occurred in a given storm period (48 hours duration) were similarly treated (either all seeded or all not-seeded). GRA

N76-26757# R and D Associates, Marina Del Rey, Calif.
REMOTE ASSESSMENT OF GASES Final Technical Report
Leona Marshall Libby Sep. 1975 197 p refs
(Contract MDA903-74-C-0090; ARPA Order 2558)
(AD-A019240; RDA-TR-4302-001) Avail: NTIS CSCL 04/1

Remote assessment of gases by spectroscopic means is presented. The 'windows' of the atmosphere are described. Electromagnetic signatures of gaseous molecules from 1 Mc to 4000 A are computed and the methods to compute are explained. Passive and active methods which have been successful are described. Lasers and solid state detectors which might be useful are surveyed. GRA

N76-26758# Texas Instruments, Inc., Dallas. Equipment Group.
SOURCE STUDIES IN THE NEAR AND FAR FIELD Semiannual Technical Report, 1 Nov. 1974 - 30 Apr. 1975
Lawrence S. Turnbull, Jr., James C. Battis, David Sun, and Alan C. Strauss 30 May 1975 109 p refs
(Contract F44620-73-C-0055; ARPA Order 1827)
(AD-A019577; TI-ALEX(02)-tr-75-01-Pt-A; AFOSR-75-1559TR; SATR-4-Pt-A) Avail: NTIS CSCL 17/10

Examination of the seismic source from both the near- and farfields has been undertaken. Using a discrete Fourier transform (DFT) and a maximum entropy spectral estimator on near-field acceleration data produced corner frequency and low frequency level estimates. This latter estimator eliminates leakage, thereby obtaining more accurate values for the high frequency end, with better roll-off values and definition of side lobes. When the maximum entropy spectral estimator was applied to data from the Parkfield earthquake and the Bear Valley event of June 22, 1973, the lower frequency level was lower than that from the DFT in all cases. Using spectral fitting procedures on fundamental mode surface wave data from two central California events, generally close agreement was obtained with source mechanism solutions from bodywaves. For the Bear Valley earthquake of June 22, 1973, the seismic moment obtained from the surface wave data was an order of magnitude smaller than that obtained from acceleration data. GRA

N76-26759# Panametrics, Inc., Waltham, Mass.
DESIGN, FABRICATION, AND FLIGHT OF A UV SPECTROPHOTOMETER ABOARD A WB57F HIGH ALTITUDE AIRCRAFT FOR THE CIAP FLIGHT SERIES- SUMMARY REPORT Final CIAP report, 1 Sep. 1972 - 30 Nov. 1975
Frederick A. Hanser, Bach Sellers, and Jean L. Hunerwadel Dec. 1975 83 p refs Sponsored in part by DOT
(Contract N00014-73-C-0316)
(AD-A019745; PANA-UVS-7) Avail: NTIS CSCL 14/2

An ultraviolet interference-filter spectrophotometer has been designed, fabricated, and installed on a WB57F high altitude (about 60 kft) aircraft as part of the Department of Transportation Climatic Impact Assessment Program. This instrument (designated the UVS, or UV Spectrophotometer) uses a UV diffuser, ten filters (sets) placed in a rotating wheel, and a high grade reggedized photomultiplier to provide 12 second time-resolved UV spectra in the region between 200 and 400 nm. The objectives of the UVS are to provide SST altitude UV flux data (1) of aid in interpretation of other, simultaneous measurements made on the aircraft, and (2) for purposes of long term monitoring of geographical and seasonal variations. The operating history of the UVS is described and some graphical presentation of total ozone data are given. The UVS has proved very reliable, operating under the extreme environmental conditions of high altitude aircraft flight with no difficulty. Two years of CIAP deployment on the WB57F have demonstrated the long term stability of the UVS. The UVS has proven itself a valuable instrument for various atmospheric monitoring programs. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N76-26760 Wyoming Univ., Laramie.
AN EXAMINATION OF BAND COMPARISON AND APPLICATION AT 426 KHz TO THE MEASUREMENT OF SHOWER IONIZATION RADIO EMISSION Ph.D. Thesis
Paul Frederick Rodney 1975 189 p
Avail: Univ. Microfilms Order No. 76-13522

The concept of band comparison is investigated for white noise, and a modified form of band comparison is developed. An alternative to using band comparison to search for transient signals in noise is to use a signal-to-noise ratio test. In practice, a combination of a band comparison test and a signal-to-noise ratio test is usually much more effective than either test. Simulation of shower ionization radio emission with noise and analysis of such a signal using a combined band comparison and signal-to-noise ratio test reveals that there is often a delay between the time the peak amplitude of the shower ionization radio emission is received and the time at which it is detected. It is concluded that fields on the order of 10 to the 5th power V/m are either generally confined to small regions of a thundercloud, or that the field distribution in the cloud is so complicated as to obscure the modulation of the shower ionization electron current.
Dissert. Abstr.

N76-26761 Miami Univ., Coral Gables, Fla.
A NUMERICAL MODEL OF TROPICAL UPPER TROPOSPHERIC COLD CORE CYCLONES Ph.D. Thesis
Joseph McCormack Pelissier 1975 163 p
Avail: Univ. Microfilms Order No. 76-12830

An effort is made to demonstrate that differential infrared radiational cooling between the clear center and cloudy periphery can account for the cold core and maintain the radial temperature and pressure gradients necessary to drive the circulation. The infrared cooling hypothesis is examined by means of a numerical model. A scale analysis demonstrates that radiational cooling can offset adiabatic warming in the subsiding core region and account for the cold center when the descending motion is of the order of one centimeter per second. This is confirmed by the numerical integration. Other experiments include those in which (a) the initial state is at rest, (b) the radiation gradient is eliminated after the transverse circulation develops, (c) convection is enhanced, and (d) the horizontal scale of the radiation gradient is varied. Limitations of the model are discussed. Dissert. Abstr.

N76-26762*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF THE NIMBUS 5 ESMR TO RAINFALL DETECTION OVER LAND SURFACES Final Report, Nov. 1974 - Nov. 1975
Jack M. Meneely Nov. 1975 53 p refs
(Contract NAS5-20878)
(NASA-CR-144764; ES-1008) Avail: NTIS HC $4.50 CSCL 04B

The ability of the Nimbus 5 Electrically Scanning Microwave Radiometer (ESMR) to detect rainfall over land surfaces was evaluated. The ESMR brightness temperatures (Tb sub B) were compared with rainfall reports from climatological stations for a limited number of rain events over portions of the U.S. The greatly varying emissivity of land surfaces precludes detection of actively raining areas. Theoretical calculations using a ten-layer atmospheric model showed this to be an expected result. Detection of rain which had fallen was deemed feasible over certain types of land surfaces by comparing the Tb sub B fields before and after the rain fell. This procedure is reliable only over relatively smooth terrain having a substantial fraction of bare soil, such as exists in major agricultural regions during the dormant or early growing seasons. Soil moisture budgets were computed at selected sites to show how the observed emissivity responded to changes in the moisture content of the upper soil zone. Author

N76-26763*# Colorado State Univ., Fort Collins. Dept. of Atmospheric Science.

TROPICAL OCEANIC PRECIPITATION FREQUENCY FROM NIMBUS 5 MICROWAVE DATA

Stanley Q. Kidder May 1976 58 p refs
(Grant NGR-06-002-102)
(NASA-CR-148191; CSU-ATSP-248) Avail: NTIS HC $4.50 CSCL 04B

Microwave brightness temperature data from the Nimbus 5 satellite are analyzed, using threshold brightness temperatures, to yield tropical oceanic precipitation frequencies for several classes of rainfall rates during the season December 1972 through February 1973. Data taken near local noon and near local midnight are analyzed. The overall results are consistent with both climatological precipitation frequency and with concurrent satellite-derived frequency of highly reflective clouds. The difference between the local noon and local midnight frequencies is small, but the heavier rainfall rates tend to occur more frequently near local noon. The ratios of the frequencies of light, moderate, and heavy rain were observed to be relatively constant over the tropical oceans. Passive microwave measurements from space seem to be an important step toward accurate measurement of oceanic precipitation. Author

N76-26764*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

VECTOR WIND AND VECTOR WIND SHEAR MODELS 0 TO 27 km ALTITUDE FOR CAPE KENNEDY, FLORIDA, AND VANDENBERG AFB, CALIFORNIA

O. E. Smith Jul. 1976 102 p refs
(NASA-TM-X-73319) Avail: NTIS HC $5.50 CSCL 04B

The techniques are presented to derive several statistical wind models. The techniques are from the properties of the multivariate normal probability function. Assuming that the winds can be considered as bivariate normally distributed, then (1) the wind components and conditional wind components are univariate normally distributed, (2) the wind speed is Rayleigh distributed, (3) the conditional distribution of wind speed given a wind direction is Rayleigh distributed, and (4) the frequency of wind direction can be derived. All of these distributions are derived from the 5-sample parameter of wind for the bivariate normal distribution. By further assuming that the winds at two altitudes are quadravariate normally distributed, then the vector wind shear is bivariate normally distributed and the modulus of the vector wind shear is Rayleigh distributed. The conditional probability of wind component shears given a wind component is normally distributed. Examples of these and other properties of the multivariate normal probability distribution function as applied to Cape Kennedy, Florida, and Vandenberg AFB, California, wind data samples are given. A technique to develop a synthetic vector wind profile model of interest to aerospace vehicle applications is presented. Author

N76-26765# Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.

LEAST-SQUARES FITS TO WIND PROFILES MEASURED OVER SNOW

W. N. Selander Sep. 1975 11 p ref Sponsored by ERDA
(AECL-5252) Avail: NTIS Avail: ERDA Depository Libraries HC $4.50 AECL $0.50

Based on least squares fits by logarithmic functions, it is found that wind profiles measured over snow represent aerodynamically smooth or rough flow, depending on whether the snow cover is deep or thin and intermittent. The relation between friction velocity and the one-meter wind speed for the smooth flows is in good agreement with that previously found from measurements over a smooth water surface. Author (ERA)

N76-26766# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

ANVIL AREA AND BRIGHTNESS CHARACTERISTICS AS SEEN FROM GEOSYNCHRONOUS SATELLITES M.S. Thesis

Robert M. Arn 1975 100 p refs
(AD-A018955; AFIT-CI-76-4) Avail: NTIS CSCL 04/2

Seven severe thunderstorm cells are studied in detail using ATS-3 and SMS-2 satellite data. Brightness and area characteristics of the anvils were studied to find commom denominators that might be indicative of hail or tornado activity. The best characteristics were found to be area speed gradients, volume flux, and divergence. Mass flux was available only if a radiosonde sounding had been taken through the cell. GRA

N76-26767# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

RELATIONSHIPS BETWEEN VERTICAL MOTION ON ISENTROPIC SURFACES FROM 3-HOUR RAWINSONDE DATA AND RADAR ECHOES M.S. Thesis

James W. Overall May 1975 72 p refs
(AD-A018905; AFIT-CI-76-6) Avail: NTIS CSCL 04/2

Vertical motion on isentropic surfaces obtained at 3-h intervals from NASA's second Atmospheric Variability (Pilot) Experiment (AVE IIP) conducted on 11 and 12 May 1974 is related to convection indicated by radar echoes. Temporal and spatial changes in vertical motion are shown and demonstrated to be associated with areas of convection. Vertical motion as large as 22 cm/s was calculated and it is shown that vertical motion changes as much as 20 cm/s in a horizontal distance of 300 km. The rate of change of vertical motion is demonstrated to be as large as 8 cm/s/h from data taken at 3-h intervals while data taken at 12-h intervals the same day displayed a maximum rate of change of 2 cm/s/h. Radar observations confirmed that the intensity of convection varies as a result of the atmospheric variability as detected by 3-h data but is invisible in data taken at 12-h intervals. GRA

N76-26768# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.

THE 15001 LITTLE JOHN, MISSILE NO. 1932, ROUND NO. 720 RG Meteorological Data Report

Fort Monmouth, N. J. ECOM 5 Jun. 1975 21 p
(DA Proj. 1T6-65702-D-127)
(AD-A018607; DR-891) Avail: NTIS CSCL 04/2

Meteorological data gathered for the launching of 15001 Little John, Missile Number 1932, Round Number 720 RG, are presented in tabular form. GRA

N76-26769# Naval Weather Service Detachment, Asheville, N.C.

A SYNOPTIC COMPARISON OF WIND AND WAVE REPORTS FROM OCEAN WEATHER STATION (OWS) HOTEL AND SHIPS-IN-PASSAGE M.S. Thesis

James W. Ownbey, Jr. Nov. 1975 103 p refs
(AD-A019005) Avail: NTIS CSCL 04/2

Wind speed and wave height reports from Ocean Weather Station Hotel and Ships-in-Passage through a specified area are compared synoptically to investigate possible bias in Tape Data Family-11 (a surface marine file available from the National Climatic Center). GRA

N76-26770# Naval Weather Service Command, Washington, D.C.

SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS. SIBERIAN COASTAL MARINE AREAS. VOLUME 4: AREA 22: ONEKOTAN ISLAND, AREA 23: ONEKOTAN ISLANDS SE, AREA 24: SOYA STRAIT W, AREA 25: SOYA STRAIT E, AREA 26: URUP ISLAND, AREA 27: VLADIVOSTOK, AREA 28: SEA OF JAPAN N

Oct. 1975 565 p
(AD-A018623) Avail: NTIS CSCL 04/2

The data contained in these tables were obtained from Tape Data Family 11 (TDF-11) Marine Surface Observations. A summary of Synoptic Meteorological Observations for the Siberian Coastal Marine Areas is given. GRA

N76-26771# National Academy of Sciences - National Research Council, Washington, D.C.
BOMEX BULLETIN NO. 12. FINAL REPORT OF THE BOMAP ADVISORY PANEL. US COMMITTEE FOR THE GLOBAL ATMOSPHERIC RESEARCH PROGRAM
Nov. 1975 91 p refs Sponsored in part by NSF
(PB-249749/3; NOAA-76011304) Avail: NTIS HC$5.00 CSCL 04B

This is the last issue in the Barbados Oceanographic and Meteorological Experiment (BOMEX) Series. It contains the final report of the Barbados Oceanographic and Meteorological Analysis Project (BOMAP), and includes the Report of the BOMAP Panel and the Report of the Director, BOMAP. The Panel report gives a brief synopsis on the status of BOMAP, and the achievements already reached, and then continues on to identify the critical issues remaining in the program. The report outlines, and then summarizes recommendations. The Director's report is a comprehensive overview of the entire project. Also included are three appendices that list BOMAP Publications, BOMEX Archive Products, and Status of BOMAP Data Sets. A report is included at the end which is entitled: Wind stress and turbulent energy budget measurements in the undisturbed surface boundary layer over the sea; the tern buoy experiment. GRA

N76-26772# National Oceanic and Atmospheric Administration, Boulder, Colo. Weather Modification Program Office.
A NOTE ON THE HYDROSTATIC EQUATION IN THE NHEML TWO-DIMENSIONAL HURRICANE MODEL
Michael S. Moss and Stanley L. Rosenthal Dec. 1975 21 p refs
(PB-249592/7; NOAA-TM-ERL-WMPO-26; NOAA-76011612) Avail: NTIS HC $3.50 CSCL 04B

The finite difference form of the hydrostatic equation derived for the UCLA (1974) general circulation model is examined. It is shown that the equation used to obtain the geopotential height in the lowest model layer has a large inherent truncation error. A modification of the scheme is suggested in which this height is computed by assuming that the lapse rate between the surface and the adjacent model layer is dry adiabatic. The UCLA (1974) thickness formulation is then used to compute the heights at the remaining levels. This scheme yields much more accurate heights throughout the depth of the atmosphere. GRA

N76-26773# Eddy (Amos), Inc., Norman, Okla.
OPTIMAL SAMPLING AND OBJECTIVE ANALYSIS Final Report, 1 Jan. - 30 Jun. 1975
Amos Eddy and Patrick J. Brady 27 Jun. 1975 70 p
(Contract DI-14-060-D-7633)
(PB-248791/6) Avail: NTIS HC $4.50 CSCL 04B

Three main projects are described, each of which centered around providing tested computer programs for rainfall data. Optimal rainfall accumulation time and station density concepts were derived. Optimal interpolation objective analysis routines were implemented. Sensor placement routines were provided and tested using as input simply configured shower rainfall patterns the descriptions of which are input for the user in meteorologically familiar terms. A proposed sampling and analysis model was developed which would effect an optimal combined use of radar reflectivities and surface rain gage measurements. GRA

N76-26774# California State Univ., Northridge. School of Engineering.
ESTIMATED TORNADO SPECTRA AND MAXIMUM VELOCITY STATISTICS Final Report
Dusan S. Zrnic Sep. 1975 74 p refs
(Grant NOAA-04-5-022-17)
(PB-249750/1; NOAA-76010701) Avail: NTIS HC $4.50 CSCL 04B

Maximum tornado velocity extraction by means of a Doppler radar is analyzed. Spurious spectral power that may mask velocity determination or give erroneous indication was identified, and recommendations concerning signal processing methods were given such that spurious power was kept 40 db below the signal level. Joint probability distribution and the correlation between Doppler power spectrum coefficients were derived. These statistics were to examine detection of broad spectra and to establish criteria for the presence of a signal in a velocity bin. GRA

N76-26775# National Ocean Survey, Las Vegas, Nev.
USE OF CLIMATOLOGICAL AND METEOROLOGICAL DATA IN THE PLANNING AND EXECUTION OF NATIONAL GEODETIC SURVEY FIELD OPERATIONS
Robert J. Leffler Dec. 1975 36 p refs
(PB-249677/6; NOAA-TM-NOS-NGS-1; NOAA-75121801) Avail: NTIS HC $4.00 CSCL 04B

The report describes a study that was initiated because of increased interest in the possible applications of available climatological and meteorological data to National Geodetic Survey field operations. The availability, pertinence, uses, and procedures for use of these data are described. Both climatic records and weather forecasts are considered. GRA

N76-26776# National Oceanic and Atmospheric Administration, Washington, D.C. Center for Experiment Design and Data Analysis.
RADAR AND SATELLITE PRECIPITATION ANALYSIS OF A 5-DAY BOMEX DATA SAMPLE
Michael D. Hudlow Dec. 1975 55 p refs
(PB-249589/3; NOAA-TM-EDS-BOMAP-18; NOAA-76011303) Avail: NTIS HC $4.50 CSCL 04B

Radar and satellite data are used qualitatively and quantitatively to describe the precipitation morphology for a five-day period of the Barbados Oceanographic and Meteorological Experiment (BOMEX), conducted in 1969. The period was characterized by undisturbed weather conditions, but was immediately preceded and followed by moderate and mild disturbances, respectively. Typical satellite and radar photographs are presented to illustrate cloud patterns and precipitation echoes. Minimums of cloud and echo amount are generally observed around midday; maximums, in the early morning hours. Average echo and cloud amounts for the period were found to decrease with increasing north latitude. GRA

N76-26777# National Oceanic and Atmospheric Administration, Rockville, Md. Center for Experiment Design and Data Analysis.
BOMEX RAWINSONDE ATLAS
Jun. 1975 151 p
(PB-249537/2; NOAA-76011305) Avail: NTIS HC $6.75 CSCL 04B

The report contains data collected during the first three observation periods during the Barbados Oceanographic and Meteorological Experiment (BOMEX), conducted in the summer of 1969. The report is divided into three sections, corresponding to the three observation periods. Summary 10-mb data obtained by the ships, Rainier, Mt. Mitchell, and Discoverer during Periods I and II, and by all four corner ships, including the Oceanographer, during Period III, were selected to illustrate the general characteristics of the basic atmospheric variables and to serve as a guide for investigators who may wish to analyze the archived data in more detail. The displays consist of time cross sections of specific humidity, potential temperature components, windspeed, and wind direction; temperature profiles; and pseudoadiabatic charts. GRA

N76-26778# Stanford Research Inst., Menlo Park, Calif.
IMPLEMENTATION OF THE SRI OBJECTIVE CLOUD Final Report, Jul. 1974 - Sep. 1975
D. J. Hall and Daniel E. Wolf Oct. 1975 54 p refs
(Contract N66314-74-C-2350)
(AD-A021772; EPRF-TR-9-75(SRI)) Avail: NTIS CSCL 04/2

This report describes project work for the Naval Environmental Prediction Research Facility (NEPRF) of the U.S. Navy. The unique SRI Objective Cloud Tracking System (also known as ISODATA) has been converted for use on the EPRF's computer hardware -- a NOVA computer. The original programs were written in FORTRAN for a CDC 6400 computer. The conversion has been carried out partly by means of an automatic conversion program

and partly by mutual conversion. The report not only lists the conversion operations in detail, but also documents the programs so that future improvements and adaptations to interactive use with displays can begin from a clear base. GRA

N76-26779# Western Scientific Services, Inc., Fort Collins, Colo.
DEVELOPMENT OF AN EXPERIMENTAL HYDROMETEOROLOGICAL DATA COLLECTION NETWORK, PHASE 1 Final Report
James H. Wagner 11 Feb. 1975 85 p
(Contract DI-14-06-D-7551)
(PB-248865/8; FR-807-40) Avail: NTIS HC $5.00 CSCL 04B

The development of two techniques for automatic collection of data from remote precipitation gages is presented. Both techniques use a digital precipitation gage developed as a part of this program. The ERTS-RAIN concept is designed for a network of gages operating within a 12 mile radius of an ERTS Data Central. The Airborne-RAIN concept is designed for data collection from a network of gages operating over an area of several thousand square miles. Experimental systems were developed and tested in order to demonstrate the feasibility of both concepts. Recommendations for implementation of prototype networks for evaluating the operational aspects of the network are included. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N76-26780 Miami Univ., Fla.
COASTAL WATER RESPONSE TO THE VARIABLE WIND THEORY AND COASTAL UPWELLING EXPERIMENT Ph.D. Thesis
Dong-Ping Wang 1975 183 p
Avail: Univ. Microfilms Order No. 76-12831

The theory of coastal-trapped waves was extended to include the general features of continuous density stratification, variable bottom topography, and a finite coastal wall. In the particular case of a vanishing coastal wall, topographic Rossby waves are the only class of sub-inertial frequency, trapped wave motion. The density dependence of topographic Rossby waves was measured by the ratio of the local baroclinic radius of deformation to the characteristic offshore length scale of the wave motion. For intermediate density stratification, long waves are nearly depth-independent in the shelf region, and are bottom-trapped in the slope region. The topographic Rossby waves reduce to the barotropic shelf waves and the baroclinic double-Kelvin waves in the limits of small and large density stratification, respectively. The low frequency current, wind, and sea level fluctuations off Oregon were investigated, and a wind event was examined to study the nature of coastal upwelling fluctuations. Dissert. Abstr.

N76-26781 Florida State Univ., Tallahassee.
BAROTROPIC AND BAROCLINIC COASTAL TRAPPED WAVES IN AN UPWELLING FRONTAL ZONE Ph.D. Thesis
John McGuire Bane, Jr. 1975 122 p
Avail: Univ. Microfilms Order No. 76-13799

Free coastal trapped waves propagating in a density structure typical of coastal upwelling regions are studied with an analytical model incorporating a semi-infinite continental shelf with constant slope. Two discrete density layers with depths of constant proportion occupy the region seaward of a narrow frontal zone within which the density interface turns upward to intersect the surface forming a surface-density front located about 10 km from the shoreline. The heavier fluid occupies the entire water column inshore of the surface front representing the band of cold, upwelled water found near the coast in upwelling areas. A baroclinic mean flow exists with a constant velocity everywhere in the upper layer except within the frontal zone where the velocity increases to form a coastal jet. Dissert. Abstr.

N76-26782 California Univ., San Diego.
SCATTERING OF ROSSBY WAVES BY TOPOGRAPHY IN A STRATIFIED OCEAN Ph.D. Thesis
Robert Earl Hall 1976 126 p
Avail: Univ. Microfilms Order No. 76-12862

The scattering of barotropic and first mode baroclinic Rossby waves by bottom topography in a stratified ocean is examined. The topography is a function of one horizontal coordinate and linearized to the bottom; the topographic profile, while of finite width, is arbitrary. Both continuous and multilayer stratifications are considered. The scattering problem is solved by reducing the linearized, quasi-geostrophic, potential vorticity equation to a Fredholm integral equation of the second kind across the topography and by using a method of weighted residuals to solve the integral equation. Dissert. Abstr.

N76-26783*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CALCULATION OF WIND-DRIVEN SURFACE CURRENTS IN THE NORTH ATLANTIC OCEAN
Thomas H. Rees and Richard E. Turner Washington Jun. 1976 25 p refs
(NASA-TN-D-8223; L-10740) Avail: NTIS HC $3.50 CSCL 08C

Calculations to simulate the wind driven near surface currents of the North Atlantic Ocean are described. The primitive equations were integrated on a finite difference grid with a horizontal resolution of 2.5 deg in longitude and latitude. The model ocean was homogeneous with a uniform depth of 100 m and with five levels in the vertical direction. A form of the rigid-lid approximation was applied. Generally, the computed surface current patterns agreed with observed currents. The development of a subsurface equatorial countercurrent was observed. Author

N76-26784# National Oceanic and Atmospheric Administration, Rockville, Md. Office of Coastal Zone Management.
IT'S YOUR COAST; GET INVOLVED
Jun. 1975 16 p
(PB-249676/8; NOAA-76011501) Avail: NTIS HC $3.50 CSCL 13B

The problems of the coastal zone, the responsibilities of the Office of Coastal Zone management, the coastal zone management approach, and the individual's role in coastal zone management are discussed. The state's coastal management offices are listed. GRA

N76-26785# National Oceanic and Atmospheric Administration, Rockville, Md. Office of Coastal Zone Management.
CONSIDERING COASTAL ZONE MANAGEMENT. THE LAW: THE PARTICIPANTS: THE PROGRAM
Jun. 1975 12 p
(PB-249675/0; NOAA-76011502) Avail: NTIS HC $3.50 CSCL 13B

A pamphlet describes and explains the coastal zone management law, the participants in the coastal zone management program, and the program itself. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N76-26786*# Kanner (Leo) Associates, Redwood City, Calif.
CHANGES IN THE RESISTANCE OF ANIMALS DURING 'KOSMOS-605 AND 782' BIOSATELLITE EXPERIMENTS
L. V. Serova Washington NASA Jun. 1976 11 p refs Transl. into ENGLISH from Inst. of Med. and Biol. Probl., Ministry of Public Health USSR (Moscow), 1976 9 p
(Contract NASw-2790)
(NASA-TT-F-15489) Avail: NTIS HC $3.50 CSCL 06C

Findings are presented on clinical and physiological changes in rats after flights aboard Kosmos-605 and 782. Kosmos-605 and control rats had equal lifetimes, and their descendants did not differ from the control descendants in litter size, birth weight, body and organ weight dynamics, peripheral blood and bone marrow and resistance to anoxic anoxia. Test rats from both satellites had reduced postflight motor activity, which apparently

facilitated readaptation to terrestrial gravity. Differences between test and vivarium control rats were less in Kosmos-782, apparently due to malfunction of the Kosmos-605 life support system. There were considerable individual differences in body weight, number of lymphocytes, and resistance of erythrocytes to hemolysis. It is concluded that maintenance of homeostasis at rest requires considerable exertion by the flight animals, and the possibility is raised that regulatory mechanisms are insufficient to maintain biological capabilities in activities under stress. Author

N76-26787*# Transemantics, Inc., Washington, D.C.
PRELIMINARY RESULTS OF AN EXPERIMENT WITH MAMMALS ON THE 'KOSMOS-782' BIOLOGICAL SATELLITE
N. N. Gurovskiy, O. G. Gazenko, A. M. Genin, Ye. A. Ilin, B. A. Adamovich, and A. A. Zlatorunskiy Washington NASA Jun. 1976 22 p Transl. into ENGLISH from Inst. of Med. and Biol. Probl. of the USSR Ministry of Public Health (Moscow), 1976 16 p
(Contract NASw-2792)
(NASA-TT-F-15492) Avail: NTIS HC $3.50 CSCL 06C

The research results during the flight of the 'Kosmos-782' biological satellites are described. The experiment involved the postflight examination of a large number of various representatives of the animal and vegetable kingdom after their experiencing artificial gravity created by an on-board centrifuge. Data are presented concerning mechanisms of adaptation of living systems to conditions of prolonged weightlessness and to subsequent readaptation to earth gravity. Author

N76-26788*# Kanner (Leo) Associates, Redwood City, Calif.
CHANGE IN EQUILIBRIUM FUNCTION AND STATIC RESISTANCE IN RATS AFTER A 20 DAY LONG FLIGHT IN THE 'KOSMOS-782' SATELLITE
A. R. Kotovskaya, A. A. Shipov, G. S. Ayzikov, and A. S. Markin Washington NASA Jun. 1976 12 p Transl. into ENGLISH from Inst. of Med. and Biol. Probl. of the USSR Ministry of Public Health, USSR (Moscow), 1976 8 p
(Contract NASw-2790)
(NASA-TT-F-15493) Avail: NTIS HC $3.50 CSCL 06C

Graphical data and photographs on the static resistance and equilibrium function dynamics of 12 SPF line rats as well as on ground model experiment and vivarium control animals were recorded before and after a 20 day flight in Kosmos-782. Static resistance was estimated by the time for hanging onto vertically suspended sticks and the equilibrium function by the time for leveling a see-saw on which the rats were placed. The changes in static resistance are explained by the specific effect of weightlessness, compensation for which is a longer process than compensation for the holding conditions. The equilibrium recovery dynamics indicate changes in the function of the vestibular apparatus. Author

N76-26789*# Scientific Translation Service, Santa Barbara, Calif.
CHANGES IN THE BIOCHEMICAL INDICATORS OF THE BLOOD OF RATS FOLLOWING THE FLIGHT OF THE 'KOSMOS-782' BIOLOGICAL SATELLITE
R. A. Tigranyan, I. A. Popova, M. I. Belyakova, N. F. Kalita, L. B. Sochilina, and Ye. G. Tuzova Washington NASA Jun. 1976 6 p Transl. into ENGLISH from Inst. of Med. and Biological Probl., Ministry of Health, USSR (Moscow), 1976 p 1-3
(Contract NASw-2791)
(NASA-TT-F-15490) Avail: NTIS HC $3.50 CSCL 06C

The results of studies conducted on male rats of the SPF line which were in space flight for 20 days aboard the 'Kosmos-782' biological satellite are reported. Author

N76-26790*# Scientific Translation Service, Santa Barbara, Calif.
MORPHOLOGICAL INVESTIGATION OF THE ORGANS AND TISSUES OF ANIMALS AFTER FLIGHT ABOARD THE 'KOSMOS-782' SATELLITE
V. V. Portugalov, Ye. A. Savina, A. S. Kaplanskiy, G. N. Durnova, and A. S. Pankova Washington NASA Jun. 1976 8 p Transl. into ENGLISH from Inst. of Med. and Biol. Probl. of the USSR Ministry of Public Health, Moscow (USSR), 1976 p 1-6
(Contract NASw-2791)
(NASA-TT-F-15494) Avail: NTIS HC $3.50 CSCL 06C

A study is made of the morphological manifestations of reactions of the intact organism in response to the prolonged stay of animals under conditions of weightlessness. Animals from the Kosmos-782 satellite were used. Author

N76-26791*# Scientific Translation Service, Santa Barbara, Calif.
ROLE OF MONOVALENT CATIONS IN THE MEMBRANE ORGANIZATION OF MODERATELY HALOPHILIC BACTERIA
Masui Masamiki, Otani Eiichi, and Kato Keiya Washington NASA Jun. 1976 24 p refs Transl. into ENGLISH from Tokyo Daigaku, Oyo Biseibutsu Kenkyujo Symp. (Japan), v. 11, 1969 p 65-79
(Contract NASw-2791)
(NASA-TT-F-17030) Avail: NTIS HC $3.50 CSCL 06M

The optimum growth conditions for slightly halophilic, moderately halophilic, and highly halophilic bacteria are reviewed, and the occurence of halophilic bacteria in nature is examined (i.e., in salt lakes, salted meat). The optimum sodium chloride concentrations needed for growth of moderately halophilic bacteria was experimentally investigated. A synthetic medium suitable for growth of the bacteria is described. The wild strains of Pseudomonas sp. and Micrococcus sp. were chosen for study in the experimental investigation. The effects of desalinization on bacterial growth, and specifically the rupturing of cell membranes, were studied. Results indicate that cell wall ruptures occurring during desalinization happen because of sodium ion depletion. The role of other ions, magnesium and potassium, in regulating the amount of sodium ions in the cell membranes is discussed. However, results also show that the sodium ion plays no part in the prevention of cell wall rupture because of osmotic pressure changes in the plasma mambranes. Data are given on the chemical composition of the cell walls of the bacteria, and photographs are shown of the ruptured cell walls. J.R.T.

N76-26792*# Scientific Translation Service, Santa Barbara, Calif.
A MANUAL ON THE STUDY OF BIOLOGICAL OXIDATION BY THE POLAROGRAPHIC METHOD
Ye. A. Kovalenko Washington NASA Jun. 1976 33 p refs Transl. into ENGLISH from the book "Rukovodstvo po Izucheniyu Biologicheskogo Okisleniya Polyarograficheskim Metodam" Moscow, Nauka Press, 1973 p 192-213
(Contract NASw-2791)
(NASA-TT-F-17040) Avail: NTIS HC $4.00 CSCL 06C

A detailed investigation is made of the stages in PO2 cascades, and a diagram is given of the dynamics of CO2 in the organism. Experiments to explain what happens in the blood and tissues of the brain when there is a great decrease in PCO2 in the organism are described. Author

N76-26793*# Joint Publications Research Service, Arlington, Va.
NEW DATA ON CIRCADIAN BIORHYTHMICITY OF WAKEFULNESS AND SLEEP IN VERTEBRATES
I. G. Karmanova Washington NASA Apr. 1976 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 225, no. 6, 21 Dec. 1975 p 1457-1460
(NASA Order W-13183)
(NASA-TT-F-16986) Avail: NTIS HC $3.50 CSCL 06C

Data are presented on the circadian periodicity of wakefulness and sleep. The material was obtained on the basis of a study of the species-specific features of diurnal periodicity in fish, amphibians, reptiles, and birds. The total duration of wakefulness and sleep at different times of the day was compared in different vertebrate species which conduct daytime and nocturnal lives. The probability coefficient of the transition of one state into the other in both the daytime and nocturnal periods was determined. Results are discussed. J.M.S.

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N76-26794 Georgia Inst. of Tech., Atlanta.
AN EXPERIMENTAL INVESTIGATION OF STEADY AND PULSATILE FLOW THROUGH PARTIAL OCCLUSIONS IN A RIGID TUBE Ph.D. Thesis

Robert Anthony Cassanova 1975 279 p
Avail: Univ. Microfilms Order No. 76-12615

Steady and pulsatile water flow through an axisymmetric constriction in a rigid tube was investigated to study the problem of subtotal vascular stenosis occurring with arteriosclerosis. Dye tracers were employed to visualize the flow field structure in both steady and pulsatile flow. Vortex shedding in the near distal region, the break-up of the vortices into random turbulence and wall interactions were observed and photographed. The sharp-edged occlusions produced flow instabilities at a lower Reynolds number than did the contoured occlusion. The presence of highly turbulent flow fields distal to the modelled stenoses implies that turbulence can be a factor in the development of postenotic dilatation. Slight degrees of stenosis produced detectable turbulence in pulsatile flow. This fact suggests that the initial formation of occlusions could be detected long before audible turbulence is produced if more sensitive diagnostic instruments could be utilized in clinical practice. Dissert. Abstr.

N76-26795 Oklahoma Univ., Norman.
MOTION SICKNESS SUSCEPTIBILITY: VESTIBULAR AND NONVESTIBULAR CHARACTERISTICS Ph.D. Thesis
James Michael Lentz 1975 97 p
Avail: Univ. Microfilms Order No. 76-14091

The relationships between motion sickness susceptibility and measures of nystagmus and sensations of rotation are studied. Secondary areas of interest included the relationship of motion sickness susceptibility to subjective alertness and anxiety, the duration of spiral aftereffect illusions, and psychomotor performance in vestibularly static and dynamic environments. From the rotation trials, it was concluded that the primary vestibular responses studied (nystagmus and sensation of rotation) were not differentially expressed in susceptible and nonsusceptible individuals. The traditional notion that susceptibility is merely a reflection of the sensitivity of an individual's vestibular system was not supported. The results did provide partial support for Graybiel's theory which proposes that the difference between susceptible and nonsusceptible individuals is determined either by the secondary vestibular response system (V-II system) or by intervening factors which mediate or influence the transmission of vestibular signals to the V-II system. Dissert. Abstr.

N76-26796 Pennsylvania Univ., Philadelphia.
HUMAN TEMPERATURE REGULATION AND THE PERCEPTION OF THERMAL COMFORT Ph.D. Thesis
Raymond Clifford Hawkins 1975 163 p
Avail: Univ. Microfilms Order No. 76-12286

Human thermoregulatory reactions to internal and external sources of thermal stress were studied at three interrelated levels of measurement: (1) physiological thermoregulatory reactions (sweating and shivering reports), (2) behavioral thermoregulatory reactions, and (3) alternations in thermal consciousness, i.e., systematic shifts in the perceived pleasantness/unpleasantness of external thermal stimuli. A major aim was to test the hypothesis that thermal comfort and thermpregulatory behavior are closely related to changes in internal body temperature (a phenomenon called thermal alliesthesia). The overall findings are that (1) warmer stimulus temperatures are behaviorally preferred and perceived as pleasant as internal temperature was lowered, and (2) cooler temperatures were perferred and perceived as pleasant as internal temperature was raised. Dissert. Abstr.

N76-26797*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, (SUPPLEMENT 154), MAY 1976
May 1976 79 p
(NASA-SP-7011(154)) Avail: NTIS HC $5.00 CSCL 06E

This bibliography lists 253 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1976. Author

N76-26798*+ National Aeronautics and Space Administration, Washington, D.C.
AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES, (SUPPLEMENT 155), JUNE 1976
Jun. 1976 61 p
(NASA-SP-7011(155)) Avail: NTIS HC $4.50 CSCL 06E

This bibliography lists 173 reports, articles, and other documents introduced into the NASA scientific and technical information system in May 1976. Author

N76-26799*# National Aeronautics and Space Administration, Washington, D.C.
FOUNDATIONS OF SPACE BIOLOGY AND MEDICINE. VOLUME 1: SPACE AS A HABITAT
Melvin Calvin, ed. and Oleg G. Gazenko, ed. NASA and Acad. of Sci., USSR 1975 458 p refs Prepared in cooperation with Acad. of Sci. (USSR), Moscow Original contains color illustrations 3 Vol.
(NASA-SP-374-Vol-1; LC-74-600174-Vol-1) Avail: NTIS MF $2.25; SOD HC $11.75 CSCL 06F

Cosmological aspects of the universe are discussed in relation to exobiological research in the context of modern biochemistry and biophysics. For individual titles, see N76-26800 through N76-26808.

N76-26800* Harvard Coll. Observatory, Cambridge, Mass.
THEORIES OF THE ORIGIN AND NATURE OF THE UNIVERSE c90
A. G. W. Cameron *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 3-31 refs (For availability see N76-26799 17-52)
CSCL 03B

The origin of life on earth is seen arising as a natural consequence of a long series of physical and chemical processes taking place in association with evolution of the universe. The present theory is that any premordial earth atmosphere, resulting from accumulation from the primitive solar nebula, was probably swept away by the very intensive T Tauri stage of the solar wind. Subsequently, the present atmosphere and oceans of the earth were outgassed from the interior. Biochemical components of the gases were mainly water vapor and carbon dioxide.
Author

N76-26801* Moscow State Univ. (USSR). Scientific Research Inst. of Nuclear Physics.
PHYSICAL CHARACTERISTICS OF INTERPLANETARY SPACE c90
S. N. Vernov, Yu. I. Logachev, and N. F. Pisarenko (Acad. of Sci., Moscow) *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 32-111 refs (For availability see N76-26799 17-52)
CSCL 03B

The most important properties of the interplanetary medium are its interplanetary plasma (solar wind), magnetic field, galactic and solar cosmic rays, and micrometeorite material. Also considered is electromagnetic radiation from the sun, stars, and the galaxy. G.G.

N76-26802* California Univ., San Diego.
THE MOON AND ITS NATURE c91
Harold C. Urey *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 115-132 refs (For availability see N76-26799 17-52)
(Grant NGR-05-009-150)
CSCL 03B

The moon and its relation to earth and sun is analyzed. It is shown that the moon was formed at comparatively low temperatures, heated on its surface by external heat sources, cooled sufficiently and at adequate depth to permit large craters to retain negative gravitational anomalies, and to support mass concentrations on the rigid interior. Moon soil resulted mostly from ash flow and was remelted in limited amounts by radioactive heat. Evidence for living or fossile forms on the moon has not been found. G.G.

N76-26803* Academy of Sciences (USSR), Moscow. Inst. of Applied Mathematics.
EARTH-TYPE PLANETS (MERCURY, VENUS, AND MARS) c91
M. Ya. Marov and V. D. Davydov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 133-196 refs (For availability see N76-26799 17-52)
CSCL 03C

Spacecraft- and Earth-based studies on the physical nature of the planets Mercury, Venus, and Mars are reported. Charts and graphs are presented on planetary surface properties, rotational parameters, atmospheric compositions, and astronomical characteristics. G.G.

N76-26804* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETS AND SATELLITES OF THE OUTER SOLAR SYSTEM, ASTEROIDS, AND COMETS **c91**
Ray L. Newburn, Jr. and Samuel Gulkis *In its* Found. of Space Biol. and Med., Vol. 1 1975 p 197-268 refs (For availability see N76-26799 17-52)
(Contract NAS7-100)
CSCL 03C

The cosmogenic significance of outer solar system objects is evaluated with emphasis on planets and larger satellites of greatest biological interest; comets, asteroids, and the smaller satellites are also discussed. Principal physical and rudimentary photometric data for the five outer planets are presented in tables. Sufficient information on planetary motions is included for most calculations in physical planetology. G.G.

N76-26805* Academy of Sciences (USSR), Moscow. Inst. of Microbiology.
BIOLOGICAL EFFECTS OF EXTREME ENVIRONMENTAL CONDITIONS **c55**
A. A. Imshenetskiy *In* NASA, Washington, Found. of Space Biol. and Med., Vol. 1 1975 p 271-320 refs (For availability see N76-26799 17-52)
CSCL 06F

Actions of extreme physical and chemical space factors on microorganisms and plants are elaborated in order to establish limits for the biosphere. Considered are effects of low and high temperatures; ionizing and ultraviolet radiation; various gases; and effects of vibration, desiccation and acceleration. G.G.

N76-26806* Academy of Sciences (USSR), Moscow. Inst. of Biochemistry.
THEORETICAL AND EXPERIMENTAL PREREQUISITES OF EXOBIOLOGY **c55**
A. I. Oparin *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 321-367 refs (For availability see N76-26799 17-52)
CSCL 06F

Evolutionary development of carbon compounds in the initial formation of life on earth is traced through two paths of nucleosynthesis: one, stable, is related to the mechanism of stellar radiation in stable stars; and the other unstable, is related to supernovae bursts. The possibility of abionic synthesis of biologically significant compounds was demonstrated in model tests for biomonomers and biopolymers. G.G.

N76-26807* Moscow State Univ. (USSR). Problem Lab. of Space Biology.
SEARCH FOR AND INVESTIGATION OF EXTRATERRESTRIAL FORMS OF LIFE **c55**
A. B. Rubin *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 368-402 refs (For availability see N76-26799 17-52)
CSCL 06F

Correct combinations of remote, analytic, and functional methods and measuring devices for detecting extraterrestrial life are elaborated. Considered are techniques and instruments available both on earth and aboard spacecraft and artificial planetary satellites. Emphasis is placed on the abiogenetic synthesis of organic compounds formed in photosynthesis on Mars. G.G.

N76-26808* National Aeronautics and Space Administration, Washington, D.C.
PLANETARY QUARANTINE: PRINCIPLES, METHODS, AND PROBLEMS **c55**
Lawrence B. Hall *In its* Found. of Space Biol. and Med., Vol. 1 1975 p 403-430 refs (For availability see N76-26799 17-52)
CSCL 06F

Requirements for planetary quarantine programs focus on microbial life forms as the primary contamination threat carried by spacecraft to a planet, or back to earth from another planet or outer space. Constraints on planetary flight missions and forthcoming Martian landings are depicted. G.G.

N76-26809*# National Aeronautics and Space Administration, Washington, D.C.
FOUNDATIONS OF SPACE BIOLOGY AND MEDICINE. VOLUME 2, BOOK 1: ECOLOGICAL AND PHYSIOLOGICAL BASES OF SPACE BIOLOGY AND MEDICINE
Melvin Calvin, ed. and Oleg G. Gazenko, ed. NASA and Acad. of Sci., USSR 1975 415 p refs Prepared in cooperation with Acad. of Sci. (USSR), Moscow 3 Vol.
(NASA-SP-374-Vol-2-Bk-1; LC-74-600174-Vol-2-Bk-1) Avail: NTIS MF $2.25; SOD HC $9.40 CSCL 06S

Barometric pressure, gas composition, toxicity, and thermal exchange of spacecraft cabin atmospheres are discussed. Effects of gravitation, acceleration, weightlessness, noise, and vibration on human behavior and performance during space flight are also described. For individual titles, see N76-26810 through N76-26818.

N76-26810* Ministry of Health of the USSR, Moscow.
BAROMETRIC PRESSURE AND GAS COMPOSITION **c54**
V. B. Malkin *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 3-64 refs (For availability see N76-26809 17-52)
CSCL 06K

Many factors affecting artificial gas atmosphere, which is used to maintain life during space flight, are considered. The wide variability of barometric pressure in spacecraft, due in large measure to spacecraft design is discussed. Explosive decompression is described; this develops from instantaneous depressurization of the cabin. Decompression sickness is reviewed, including bubble growth and evolution of gas bubbles in organisms. Dysbarism, hypoxia, and hypercapnia are also discussed. J.A.M.

N76-26811* National Academy of Sciences - National Research Council, Washington, D.C.
TOXICOLOGY OF THE AIR IN CLOSED SPACES
Ralph C. Wands *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 65-93 refs (For availability see N76-26809 17-52)
CSCL 06T

Sources and identification of contaminants in artificial gas atmospheres are discussed. They include biological sources (microflora and man), materials, processes, aerosols, and malfunctions. Acute or chronic toxicity may result from spacecraft air contamination. Air quality standards are presented in tabular form. J.A.M.

N76-26812* Webb Associates, Yellow Springs, Ohio.
THERMAL EXCHANGES AND TEMPERATURE STRESS
Paul Webb *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 94-126 refs (For availability see N76-26809 17-52)
CSCL 06S

Thermal comfort during space flight is discussed. Heat production of man during space flight and wear loss as a mean of dissipating heat are described. Water cooled garments are also considered, along with tolerance for extreme heat and body heat storage. Models of human temperature regulation are presented in the form of documented FORTRAN programs. J.A.M.

N76-26813* California Univ., Davis.
PRINCIPLES OF GRAVITATIONAL BIOLOGY
Arthur H. Smith *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 129-162 refs (For availability see N76-26809 17-52)
CSCL 06S

Physical principles of gravitation are enumerated, including gravitational and inertial forces, weight and mass, weightlessness, size and scale effects, scale limits of gravitational effects, and gravity as biogenic factor. Statocysts, otolithic organs of vertebrates, gravity reception in plants, and clinostat studies for gravitation orientation are reviewed. Chronic acceleration is also studied, as well as physiology of hyper and hypodynamic fields. Responses of animals to a decreased acceleration field are

examined, considering postural changes, work capacity, growth, and physiologic deadaptation. J.A.M.

N76-26814* Ministry of Health of the USSR, Moscow.
PROLONGED LINEAR AND RADIAL ACCELERATIONS
P. V. Vasilyev and A. R. Kotovskaya *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 163-213 refs (For availability see N76-26809 17-52)
CSCL 06S

Overall acceleration effects on the body and man's resistance to it are presented, including endurance limits, acceleration tolerances, and aftereffects. These effects on individual body systems are described for: (1) cardiovascular system, (2) respiratory system, (3) vision, (4) central nervous system, (5) endocrine glands, (6) gastrointestinal tract, and (7) renal system. Work capacity effects are also noted. J.A.M.

N76-26815* Air Force Systems Command, Wright-Patterson AFB, Ohio.
IMPACT ACCELERATIONS
Henning E. VonGierke and James W. Brinkley *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 214-246 refs (For availability see N76-26809 17-52)
CSCL 06S

The degree to which impact acceleration is an important factor in space flight environments depends primarily upon the technology of capsule landing deceleration and the weight permissible for the associated hardware: parachutes or deceleration rockets, inflatable air bags, or other impact attenuation systems. The problem most specific to space medicine is the potential change of impact tolerance due to reduced bone mass and muscle strength caused by prolonged weightlessness and physical inactivity. Impact hazards, tolerance limits, and human impact tolerance related to space missions are described. J.A.M.

N76-26816* Naval Aerospace Medical Inst., Pensacola, Fla.
ANGULAR VELOCITIES, ANGULAR ACCELERATIONS, AND CORIOLIS ACCELERATIONS
Ashton Graybiel *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 247-304 refs (For availability see N76-26809 17-52)
CSCL 06S

Weightlessness, rotating environment, and mathematical analysis of Coriolis acceleration is described for man's biological effective force environments. Effects on the vestibular system are summarized, including the end organs, functional neurology, and input-output relations. Ground-based studies in preparation for space missions are examined, including functional tests, provacative tests, adaptive capacity tests, simulation studies, and antimotion sickness. J.A.M.

N76-26817* Federal Aviation Administration, Washington, D.C.
WEIGHTLESSNESS
I. D. Pestov (Central Aviation Hospital, Moscow) and Siegfried J. Gerathewohl *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 305-354 refs (For availability see N76-26809 17-52)
CSCL 06S

Significance of gravitation forces in regulating homeostasis is discussed, along with weightlessness effects on humans and a state of reduced weight (subgravity), such as on the moon. Biomedical effects of weightlessness adaptation to zero G and readaptation to terrestrial gravitation are described for the nervous system, cardiovascular system, metabolism, and musculoskeletal system. Reactions caused primarily by: (1) changes in the afferent nervous system, (2) lack of hydrostatic blood pressure, (3) lack of weight on the musculoskeletal system, and (4) exposure limits derived from the effects of prolonged weightlessness on humans are reviewed. Protection of humans from adverse effects of weightlessness is considered; Skylab missions are also summarized. J.A.M.

N76-26818* Air Force Systems Command, Wright-Patterson AFB, Ohio.
NOISE AND VIBRATION
Henning E. VonGierke, Charles W. Nixon, and John C. Guignard (Dayton Univ.) *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 355-405 refs (For availability see N76-26809 17-52)
CSCL 06S

The characteristics of acoustic energy and protection of humans from noise during space flight are described. Vibration characteristic factors are also discussed, including the variety of vibration, systems and resonance, spacecraft operations, biodynamics, physiological and psychological effects, and subjective reactions. The criteria and limits for human exposure are cited. J.A.M.

N76-26819*# National Aeronautics and Space Administration, Washington, D.C.
FOUNDATIONS OF SPACE BIOLOGY AND MEDICINE. VOLUME 2, BOOK 2: ECOLOGICAL AND PHYSIOLOGICAL BASES OF SPACE BIOLOGY AND MEDICINE
Melvin Calvin, ed. and Oleg G. Gazenko, ed. NASA and Acad. of Sci., USSR 1975 756 p refs Prepared in cooperation with Acad. of Sci., (USSR), Moscow 3 Vol.
(NASA-SP-374-Vol-2-Bk-2; LC-74-600174-Vol-2-Bk-2) Avail: NTIS MF $2.25; SOD HC $8.80 CSCL 06S

The influence on living organisms of radiant energy, the psychophysical problems of space flight, methods of physiological investigations in flight, and the transmission of information are considered. For individual titles, see N76-26820 through N76-26828.

N76-26820* Rochester Univ., N.Y.
RADIO-FREQUENCY AND MICROWAVE ENERGIES, MAGNETIC AND ELECTRIC FIELDS
Sol M. Michaelson *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 2 1975 p 409-452 refs (For availability see N76-26819 17-52)
CSCL 06R

The biological effects of radio frequency, including microwave, radiation are considered. Effects on body temperature, the eye, reproductive systems, internal organs, blood cells, the cardiovascular system, and the central nervous system are included. Generalized effects of electric and magnetic fields are also discussed. Experimentation with animals and clinical studies on humans are cited, and possible mechanisms of the effects observed are suggested. D.M.L.

N76-26821* California Univ., San Diego.
ULTRAVIOLET, VISIBLE, AND INFRARED RAYS
John H. Taylor and A. A. Letavet (Acad. of Sci., USSR) *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 2. 1975 p 453-472 refs (For availability see N76-26819 17-52)
CSCL 06R

Sources of infrared, visible and ultraviolet radiation are discussed, and important associated biological and psychophysiological effects are described. The problem of protection from excessively high or low levels of radiant energy in these spectral regions is considered and optimal levels are suggested. Author

N76-26822* California Univ., Berkeley.
IONIZING RADIATION
Cornelius A. Tobias and Yu. G. Grigoryev (Ministry of Health USSR) *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 2 1975 p 473-531 refs (For availability see N76-26819 17-52)
CSCL 06R

The biological effects of ionizing radiation encountered in space are considered. Biological experiments conducted in space and some experiences of astronauts during space flight are described. The effects of various levels of radiation exposure and the determination of permissible dosages are discussed. D.M.L.

N76-26823* Air Force Systems Command, Brooks AFB, Tex.
BIOLOGICAL AND PHYSIOLOGICAL RHYTHMS
Hubertus Strughold and Henry B. Hale *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 2 1975 p 535-570 refs (For availability see N76-26819 17-52)
CSCL 06P

Circadian rhythms, particularly that of sleep and wakefulness, are discussed. The sleep-wakefulness experiences of astronauts during several space missions are described, and predictions are

made for future space activities, including Mars missions, interstellar flight, and life on permanent space stations. D.M.L.

N76-26824* Ministry of Health of the USSR, Moscow.
PHYSIOLOGY OF THE SENSORY SPHERE UNDER SPACE-FLIGHT CONDITIONS
Ye. M. Yuganov and V. I. Kopanev (Military Medical Acad. USSR) *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 2 1975 p 571-599 refs (For availability see N76-26819 17-52)
CSCL 06S

Information regarding the influence on sensory perception of certain space flight factors, including weightlessness, acceleration, and vibration, is presented. Several illusions which occur under these conditions are described. The results of ground based experiments are also discussed. D.M.L.

N76-26825* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ASTRONAUT ACTIVITY
Joseph P. Loftus, Jr., Robert L. Bond, and Rollin M. Patton *In its* Found. of Space Biol. and Med., Vol. 2, Bk. 2 1975 p 600-636 refs (For availability see N76-26819 17-52)
CSCL 06S

Human factors pertinent to the design and operation of spacecraft are considered. The geometric characteristics of spacecraft that define the degree and type of confinement imposed on the crew and the character of equipment management and housekeeping necessary for hygiene, comfort and safety are discussed. The controls and displays of various spacecraft are described to indicate the degree to which crew functions become integral to functions of the total spacecraft. The contributions of the crew to system reliability and performance are summarized and the increasing significance of the crew's role in scientific observation and experimentation is noted.
Author

N76-26826* Academy of Sciences (USSR), Pushchino.
COMBINED EFFECT OF FLIGHT FACTORS
V. V. Antipov, B. I. Davydov (Ministry of Health USSR), V. V. Verigo (Ministry of Health USSR), and Yu. M. Svirezhev (Ministry of Health USSR) *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 2 1975 p 639-667 refs (For availability see N76-26819 17-52)
CSCL 06S

The effects of various combinations of space flight stresses are discussed. Included are weightlessness, acceleration, vibration, ionizing radiation, hypoxia, and ambient temperature. The problem of constructing mathematical models to describe the dynamics of biological systems, including those to analyze and predict adaptation and restoration processes following combined stresses, is also considered. D.M.L.

N76-26827* Ministry of Health of the USSR, Moscow.
METHODS OF INVESTIGATION IN SPACE BIOLOGY AND MEDICINE, TRANSMISSION OF BIOMEDICAL DATA
R. M. Bayevskiy and W. Ross Adey (Calif. Univ., Los Angeles) *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 2 1975 p 668-706 refs (For availability see N76-26819 17-52)
CSCL 06B

Methods for in-flight monitoring of the cardiovascular system, respiratory system, vestibular system, central nervous system, and the musculoskeletal systems are described. Methods of data analysis are also discussed. D.M.L.

N76-26828* Ministry of Health of the USSR, Moscow.
BIOLOGIC GUIDELINES FOR FUTURE SPACE RESEARCH
G. P. Parfenov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 2 1975 p 707-739 refs (For availability see N76-26819 17-52)
CSCL 06B

Biological experiments conducted onboard balloons, rockets, and spacecraft are described. The effects of aerospace environments on microorganisms, plants, and invertebrate animals were examined. D.M.L.

N76-26829*# National Aeronautics and Space Administration, Washington, D.C.
FOUNDATIONS OF SPACE BIOLOGY AND MEDICINE. VOLUME 3: SPACE MEDICINE AND BIOTECHNOLOGY
Melvin Calvin, ed. and Oleg G. Gazenko, ed. NASA and Acad. of Sci., USSR 1975 542 p refs Prepared in cooperation with Acad. of Sci., (USSR), Moscow 3 Vol.
(NASA-SP-374-Vol-3; LC-74-600174-Vol-3) Avail: NTIS MF $2.25; SOD HC $11.00 CSCL 06K

The results of medical and biological research in space are presented. Specific topics discussed include: methods of providing life support systems for astronauts, characteristics of integrated life support systems, protection against adverse factors of space flight, selection and training of astronauts, and future space biomedical research. For individual titles, see N76-26830 through N76-26846.

N76-26830* California Univ., Berkeley.
BASIC DATA FOR PLANNING LIFE-SUPPORT SYSTEMS c54
Doris Howes Calloway *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 3-21 refs (For availability see N76-26829 17-52)
CSCL 06K

Nutritional, physiological, and metabolic requirements of terrestrial man are briefly reviewed in terms of manned space flight. Emphasis is placed on designing life-support systems based on experiences and accumulated data from actual space missions. J.M.S.

N76-26831* Military Medical Academy (USSR), Leningrad Lab. of Nutrition.
FOOD AND WATER SUPPLY c54
I. G. Popov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 22-55 refs (For availability see N76-26829 17-52)
CSCL 06K

Supplying astronauts with adequate food and water on short and long-term space flights is discussed based on experiences gained in space flight. Food consumption, energy requirements, and suitability of the foodstuffs for space flight are among the factors considered. Physicochemical and biological methods of food production and regeneration of water from astronaut metabolic wastes, as well as wastes produced in a closed ecological system, or as a result of technical processes taking place in various spacecraft systems are suggested for long-term space flights. J.M.S.

N76-26832* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
AIR REGENERATING AND CONDITIONING c54
B. G. Grishayenkov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 56-110 refs (For availability see N76-26829 17-52)
CSCL 06K

Various physicochemical methods of regenerating and conditioning air for spacecraft are described with emphasis on conditions which affect efficiency of the system. Life support systems used in closed, hermetically sealed environments are discussed with references to actual application in the Soviet Soyuz and Voskhod manned spacecraft. Temperature and humidity control, removal of carbon dioxide, oxygen regeneration, and removal of bacteria and viruses are among the factors considered. J.M.S.

N76-26833* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
CLOTHING AND PERSONAL HYGIENE c54
A. M. Finogenov, A. N. Azhayev, and G. V. Kaliberdin *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 111-130 refs (For availability see N76-26829 17-52)
CSCL 06K

The biomedical maintenance of astronauts is discussed in terms of personal hygiene. Principal characteristics and general requirements are described which must be followed in perfecting a system of hygienic practices and in devising means to maintain personal hygiene, flight clothing, underwear, bedding, and medical-domestic equipment for manned space flights of

varying durations. Factors discussed include: disposable clothing, thermal protection, oral hygiene, cleansing of the skin, and grooming of the hair. J.M.S.

N76-26834* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
ISOLATION AND REMOVAL OF WASTE PRODUCTS **c54**
V. V. Borshchenko *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 131-156 refs (For availability see N76-26829 17-52)
CSCL 06K

Methods of isolation and elimination of waste products in spacecraft cabins are described. The role of waste products in the environment, collection and transport of waste products to storage containers, or to recovery systems, preservation of waste products, and storage and removal of waste products are among the factors discussed. Regeneration of the waste products to recover water and/or oxygen, is briefly considered. J.M.S.

N76-26835* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
HABITABILITY OF SPACECRAFT **c54**
Yu. A. Petrov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 157-192 refs (For availability see N76-26829 17-52)
CSCL 06K

Habitability is discussed in terms of the degree of comfort and aesthetics necessary for the living, working, and resting conditions of the human operator. Organization of astronaut work regime, illumination of spacecraft working and living areas, and color are among the factors considered. J.M.S.

N76-26836* National Aeronautics and Space Administration, Washington, D.C.
INDIVIDUAL LIFE-SUPPORT SYSTEMS OUTSIDE A SPACECRAFT CABIN, SPACE SUITS AND CAPSULES **c54**
Walton L. Jones *In its* Found. of Space Biol. and Med., Vol. 3 1975 p 193-223 refs (For availability see N76-26829 17-52)
CSCL 06K

Space suit systems, physiological and operational requirements, and the technologic advances incorporated in the more advanced suits are described. Free space extravehicular activity (EVA), lunar surface EVA, and various EVA aids are considered. J.M.S.

N76-26837* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
NONREGENERATIVE LIFE-SUPPORT SYSTEMS FOR FLIGHTS OF SHORT AND MODERATE DURATION **c54**
B. A. Adamovich *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 227-246 refs (For availability see N76-26829 17-52)
CSCL 06K

The basic requirements for crew life support systems of flights of up to 30 days are described. Food products, drinking water, oxygen for breathing, and sanitary-technical facilities are among the factors considered. Life support systems utilized on Vostok, Voskhod, Soyuz, Gemini, Mercury, and Apollo are discussed. J.M.S.

N76-26838* National Aeronautics and Space Administration, Washington, D.C.
LIFE-SUPPORT SYSTEMS FOR INTERPLANETARY SPACECRAFT AND SPACE STATIONS FOR LONG-TERM USE **c54**
Walton L. Jones *In its* Found. of Space Biol. and Med., Vol. 3 1975 p 247-273 refs (For availability see N76-26829 17-52)
CSCL 06K

Integrated regenerative life support systems in which the by-products of one system become useful material for another are considered. Regeneration or reclamation of water and the principal atmospheric gases, and elimination or disposition of waste products are the principal functions of such systems. A modular system concept is described. Features of this system include: commonality (for spares reduction), maintainability, overall computer-monitored functioning, and onboard repair and replacement tasks in the event of failure. J.M.S.

N76-26839* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
BIOLOGICAL LIFE-SUPPORT SYSTEMS **c54**
Ye. Ya. Shepelev *In* NASA, Wahington Found. of Space Biol. and Med., Vol. 3 1975 p 274-308 refs (For availability see N76-26829 17-52)
CSCL 06K

The establishment of human living environments by biologic methods, utilizing the appropriate functions of autotrophic and heterotrophic organisms is examined. Natural biologic systems discussed in terms of modeling biologic life support systems (BLSS), the structure of biologic life support systems, and the development of individual functional links in biologic life support systems are among the factors considered. Experimental modeling of BLSS in order to determine functional characteristics, mechanisms by which stability is maintained, and principles underlying control and regulation is also discussed. J.M.S.

N76-26840* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
PROTECTION AGAINST RADIATION (BIOLOGICAL, PHARMACOLOGICAL, CHEMICAL, PHYSICAL) **c54**
P. P. Saksonov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 311-344 refs (For availability see N76-26829 17-52)
CSCL 06R

Physical, chemical, and biological protection for astronauts from penetrating radiation on long-term space flights is discussed. The status of pharmacochemical protection, development of protective substances, medical use of protective substances, protection for spacecraft ecologic systems, adaptogens and physical conditioning, bone marrow transplants and local protection are discussed. Combined use of local protection and pharmacochemical substances is also briefly considered. J.M.S.

N76-26841* Texas Univ., Houston.
MEDICAL CARE OF SPACECREWS, (MEDICAL CARE, EQUIPMENT, AND PROPHYLAXIS)
Charles A. Berry *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 345-371 refs (For availability see N76-26829 17-52)
CSCL 06E

Treatment and prevention of the physiologic problems of spacecrews are discussed. Preflight procedures, inflight monitoring and medication, and postflight examination are described. Specific factors covered include: medical screening and astronaut selection; health stabilization and exposure prevention; preflight medical examinations and training; biomedical data; medical kits; diagnosis and treatment; and implications of postflight findings. J.M.S.

N76-26842* Texas Univ., Houston.
DESCENT AND LANDING OF SPACECREWS AND SURVIVAL IN AN UNPOPULATED AREA
Charles A. Berry *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 372-394 refs (For availability see N76-26829 17-52)
CSCL 06S

Medical and physiologic experience gained in space flight programs of the U.S. and U.S.S.R. is described in relation to acceleration forces in the final phases of manned space flight. Application of this knowledge to future programs, survival in the postlanding period, and survival provisions currently made for spacecrews are discussed. J.M.S.

N76-26843* Military Medical Academy (USSR), Leningrad.
PROTECTION OF CREWS OF SPACECRAFT AND SPACE STATIONS **c54**
I. N. Chernyakov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 395-416 refs (For availability see N76-26829 17-52)
CSCL 06K

A survey is presented of research on life support for astronauts in emergency situations during flight. Depressurization of the spacecraft cabin, fire, and failure of air regeneration and conditioning systems of manned compartments are among the emergencies considered. J.M.S.

N76-26844* Ministry of Health of the USSR, Moscow.
SELECTION OF ASTRONAUTS AND COSMONAUTS c53
N. N. Gurovskiy, I. I. Bryanov, and Mae Mills Link *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 419-437 refs (For availability see N76-26829 17-52)
CSCL 05I

The process by which the U.S. and U.S.S.R. selected astronauts and cosmonauts for early manned space flights is described. Emphasis is placed on medical criteria. J.M.S.

N76-26845* Ministry of Health of the USSR, Moscow.
TRAINING OF COSMONAUTS AND ASTRONAUTS c53
N. N. Gurovskiy and Mae Mills Link *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 438-450 refs (For availability see N76-26829 17-52)
CSCL 05I

The biomedical and preflight training of spacecraft crews is discussed based on a survey of scientific and technical literature in the U.S. and U.S.S.R. Experience gained from high velocity and high altitude aircraft flights, predictions of human reactions and theoretical models of human adaptation to the new environment of space, and actual spaceflight experience provided scientists and specialists with data from which the state of human health in space could be predicted and life support measures developed. J.M.S.

N76-26846* National Aeronautics and Space Administration, Washington, D.C.
AN APPRAISAL OF FUTURE SPACE BIOMEDICAL RESEARCH
Sherman P. Vinograd *In its* Found. of Space Biol. and Med., Vol. 3 1975 p 453-479 refs (For availability see N76-26829 17-52)
CSCL 06B

Three general classes of manned space flight missions of the future are described. These include: earth-orbital, lunar, and planetary. Biomedical science and technology is analyzed emphasizing areas of research needed to support future manned space flights and the information to be obtained from them.
Author

N76-26847# Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
INTERNAL RADIOACTIVE CONTAMINATION IN SELECTED GROUPS OF CRNL EMPLOYEES
D. W. S. Evans Oct. 1975 18 p refs Sponsored by ERDA (AECL-5255) Avail: NTIS Avail: ERDA Depository Libraries HC $3.50; AECL $0.50

This report details the development and execution of a 30 month program designed to characterize the magnitude and distribution of internal radioactive contamination amongst selected groups of employees at Chalk River Nuclear Laboratories, using a shadow shield whole-body counter. The results show that the levels of contamination in these employees are very low, and no contaminant was present in amounts exceding 10% of the maximum permissible body burden. Details of the time course of some of the body burdens are also furnished. Author (ERA)

N76-26848# Los Alamos Scientific Lab., N.Mex.
CONSIDERATIONS IN THE ASSESSMENT OF PLUTONIUM DEPOSITION IN MAN
G. Voelz, J. Umbarger, J. McInroy, and J. Healy 1975 19 p refs Presented at IAEA Intern. Seminar on Diagn. and Treat. of Incorp. Radionuclides, Vienna, Austria, 8 Dec. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1887; Conf-751205-4) Avail: NTIS HC $4.50

Data from human cases of plutonium inhalation are used to illustrate several important problems in the current methods of estimating plutonium body burdens. Individuals exposed to 238 PuO_2 particles in a highly insoluble matrix showed an unusually slow rising urinary excretion curve over 300 to 400 days. In vivo chest counts during the first 6 months estimated lung burdens to be 10 to 30 nCi, but urinary excretion methods calculate residual systematic body burdens of 50 to 100 nCi at 1200 days after exposure. Current assumptions used in the in vivo calibration do not consider possible lung distribution of particulates soon after exposure that could alter the interpretation significantly. Tissue analysis of a lung from another case after recent inhalation exposure shows a significantly lesser concentration of plutonium in the subpleural region-the principal region of plutonium measurement by in vivo chest counting-as compared to distributions found years after exposure. Tissue analyses indicate that urinary excretion estimates of body burden over the long term tend to err on the high side up to a factor of 5 or more.
Author (ERA)

N76-26849# Atomic Energy of Canada Ltd., Chalk River (Ontario). Chalk River Nuclear Labs.
CANCER FOLLOWING MULTIPLE FLUOROSCOPIES
H. B. Newcombe Aug. 1975 37 p Sponsored by ERDA (AECL-5243) Avail: NTIS Avail: ERDA Depository Libraries HC $5.00; AECL $1.00

An epidemiological study for detecting carcinogenic effects of multiple fluoroscopies in Canadian tuberculosis patients, treated in the late 1930's to early 1950's, is described. Persons who received artificial pneumothorax treatment for tuberculosis, in the course of which they were fluoroscoped repeatedly, were studied. Roughly half of the patients with pulmonary tuberculosis, in that period, received artificial pneumothorax. That breast cancer has been caused in women by the fluoroscopies seems clear from the results of preliminary studies, but the data have a number of important limitations. These studies are not large enough to indicate differences in the risks from various numbers of fluoroscopies. Also, unless the numbers of years at risk in the irradiated and unirradiated groups can be shown to be similar, there is a possibility of bias affecting the comparison. In addition, information on the numbers of malignancies other than breast cancer, in patients of both sexes, would be of substantial importance even if no effect of the irradiations could be demonstrated. Author (ERA)

N76-26850# Rochester Univ., N.Y. School of Medicine and Dentistry.
RADIOBIOLOGIC EFFECTS AT LOW RADIATION LEVELS
G. W. Casarett 1975 14 p refs Presented at the Intern. Symp. on Areas of High Natural Radioactivity, Pocos de Caldas, Brazil, 16-20 Jun. 1975 Sponsored by ERDA
(CONF-750671-2; UR-3490-832) Avail: NTIS HC $4.50

Data are reviewed on the effects of low radiation doses on mammals. Data from the 1972 report on the Biological Effects of Ionizing Radiation issued by the Advisory Committee of the National Academy of Sciences and National Research Council are discussed. It was concluded that there are certain radiosensitive systems in which low doses of radiation may cause degenerative effects, including gametogenic epithelium, lens of the eye, and developing embryos. Despite extensive investigation of genetic effects, including chromosomal effects, neither the amount of change that will be caused by very low levels of irradiation nor the degree of associated detriment is known. ERA

N76-26851# Commissariat a l'Energie Atomique, Cadarache (France).
RECOMMENDATIONS FOR CRITICALITY ACCIDENT DOSIMETRY
Jul. 1975 75 p In FRENCH
(CEA-R-4669) Avail: ERDA Depository Libraries HC $5.00

The aims of criticality accident dosimetry and the characteristics peculiar to a critical burst are defined and the requirements to be fulfilled by a personnel dosimetric system that can be applied to this type of measurements are specified. The devices chosen are described along with the main processes to be carried out in order to evaluate doses after a radiation accident. The apparatus necessary for detector counting and the directions for use are presented in detail, allowing standardization of measurements. A set of linear formula enables to obtain, from these measurements, all wanted informations about neutron fluences and spectra, along with the suitable components of the dose at the locations of the irradiated people. Author (NSA)

N76-26852# Veterans Administration Hospital, Hines, Ill.
METABOLISM OF Sr-90 AND OF OTHER ELEMENTS IN MAN, JULY 1, 1974 - JUNE 30, 1975
31 Dec. 1975 28 p Sponsored by ERDA
(Contract AT(11-1)-1231)
(COO-1231-104) Avail: NTIS HC $4.00

Trace element studies were carried out under strictly controlled

dietary conditions in adult males during different calcium intakes. Complete metabolic balances of cadmium, copper, zinc, lead, manganese, and nickel were determined in each 6-day metabolic period by analyzing the constant diet and the urinary and fecal excretions of these naturally occurring elements. In addition to the trace element studies, Sr-85 studies were carried out in man in order to complete previously initiated investigations.

Author (NSA)

N76-26853# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

ANTIDOTE EFFECTS OF ATROPINE, TOXOGONIN, SAD 128 AND ISOPRENALIN IN RATS POISONED WITH PARAOXON [ANTIDOT-EFFEKTE VON ATROPIN, TOXOGONIN (R), SAD 128 UND ISOPRENALIN AN DER PARAOXON-VERGIFTETEN RATTE]

G. Oberdoerster Bonn DOKZENTBw 1975 29 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-75-15) Avail: NTIS HC $4.00; DOKZENTBw DM 20

In comparison to atropine and toxogonin the antidotal effects of SAD 128 and isoprenaline were investigated in paraoxon-poisoned (0.25 and 0.5 mg/kg s.c.) female Wistar rats. Blood pressure, heart frequency, action potentials of the phrenic nerve and the diaphragm, inspiratory movement of the chest as well as lung ventilation were monitored continuously. Survival time after paraoxon poisoning was significantly increased after atropine (5 mg/kg i.v.) and toxogonin (30 mg/kg i.v.). SAD 128 (5 mg/kg i.v.) was able to normalize circulation, neuromuscular activity, and phrenic nerve activity of the paraoxon treated rats, but survival time was not significantly increased. Isoprenaline (10 micro g/kg/min i.v.) showed a positive influence on the paraoxon poisoning with an increase of the activity of phrenic nerve and diaphragm. Isoprenaline improved lung ventilation and cardiac and circulatory function due to its beta-adrenergic activity.

Author (ESA)

N76-26854# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

PROTECTIVE EFFECT OF SOME PYRIDINIUM COMPOUNDS AGAINST THE INHIBITION OF STRUCTURE BOUND ACETYLCHOLINESTERASE BY SOMAN IN VITRO [SCHUTZWIRKUNG EINIGER AUSGEWAEHLTER PYRIDINIUMVERBINDUNGEN GEGEN DIE INHIBIERUNG VON STRUKTURGEBUNDENER ACETYLCHOLINESTERASE DURCH SOMAN IN VITRO]

H. Kuhnen Bonn DOKZENTBw 1975 33 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung (BMVg-FBWT-75-16) Avail: NTIS HC $4.00; DOKZENTBw DM 30

The protective effect of pyridinium compounds against the acetylcholinesterase inhibition by Soman in vitro was investigated. The relative protective effects (RS-values) were calculated, and the RS-values of the protective effects against I50 DFP and I50 Soman were compared. The protective effect is due to the chemical structure of the parent compounds and can be enhanced or decreased by substituents. The effect is not necessarily related to the reactivating power of the pyridinium compound. Substances which are not reactivators may have a relatively good protective power, e.g. SAD 128, and P 141, with the tert.-butyl and pinacolyl groups as substituents. The mechanism of action of the protective substances was interpreted by occupation of a secondary bonding site in the vicinity of the active centre. Ligand bonding at this secondary site causes conformational changes of the enzyme. This allosteric mechanism may complicate the phosphorylation of the active site.

Author (ESA)

N76-26855# Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e. V., Grafschaft (West Germany). Inst. fuer Aerobiologie.

PHARMACOKINETICS OF THE SPASMOLYTIC ACTION OF SOME BISPYRIDINIUM COMPOUNDS ON THE MUSCLE STRIP OF THE GUINEA PIG ILEUM [PHARMAKOKINETIK DER SPASMOLYTISCHEN WIRKUNG EINIGER AUSGEWAEHLTER BISPYRIDINIUM-VERBINDUNGEN AUF MUSKELSTREIFEN DES MEERSCHWEINCHENILEUM]

D. Kuhnen-Clausen Bonn DOKZENTBw 1975 46 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. der Verteidigung

(BMVg-FBWT-75-17) Avail: NTIS HC $4.00; DOKZENTBw DM 30

The antagonistic effects of some bispyridinium compounds on muscarinic and histaminic receptors were investigated on the isolated longitudinal muscle strip of the guinea pig ileum. The affinity of the derivatives is higher to muscarinic than to histaminic binding sites. A structure/activity relationship was established in both cases. Dose response curves of acetyl-beta-methylcholine were analyzed to evaluate the mechanism of drug receptor interactions on the molecular level. Protection experiments were carried out with the antagonists against the alkylation of muscarinic and histaminic receptors by dibenamine. Both receptor systems are allosteric, regulatory proteins. The theory of the receptor reserve, therefore, is contradicted. Author (ESA)

N76-26856# Whittaker Corp., Waltham, Mass. Space Sciences Div.

DEVELOPMENT OF AN IMPLANTABLE OXYGEN SENSOR: IN VIVO VALIDATION AND REFINEMENT Annual Report, Jun. 1974 - Jun. 1975

Kuo Wei Chang and Sol Aisenberg Jun. 1975 122 p refs (Contract N01-HR-33003-R)

(PB-249333/6; SSD-P-708-AR-2) Avail: NTIS HC $5.50 CSCL 06B

Sensors for continuous measurement of oxygen tension in blood, tissue and endotracheal tubes are described. These sensors are fuel cells operating in the oxygen-diffusion-limited mode. The short circuit currents of these sensors are directly proportional to the oxygen tension of the surrounding medium. The basic principle of operation, sensor construction, and results of in vitro and in vivo studies are presented in great detail. Test results obtained to date show that these sensors are accurate, stable, fast responding and calibratible with only one PO2 measurement.

GRA

N76-26857# Naval Submarine Medical Research Lab., Groton, Conn.

BODY FLUID DISTRIBUTION IN ACUTE HYPERCAPNIA Interim Report

R. D. Murray, F. T. Abbott, and K. E. Schaefer 16 Jun. 1975 14 p refs

(MR0410101)

(AD-A019922; NSMRL-814) Avail: NTIS CSCL 06/19

Guinea pigs and rats were exposed to 1.9, 6.9 and 10.8% CO2 for a period of one hour. Measurements of total body water (TBW), extracellular fluid (ECF) and intracellular fluid (ICF) were made using tritiated water and radioactive chloride (Cl36). Control values for TBW, ECF and ICF were 64.6, 28.5 and 36.1 for rats and 61.7, 30.6 and 31.1 for guinea pigs. These values did not change significantly under hypercapin. These results indicate that although no measurable changes occurred in body fluid distribution under hypercapnia, the differences in body water distribution between guinea pigs and rats may help explain species differences in response to hypercapnic stress.

Author (GRA)

N76-26858# Naval Submarine Medical Research Lab., Groton, Conn.

COMPARISON OF BIOCHEMICAL RESPONSES BETWEEN SINGLE AND REPEATED EXPOSURES TO AIR AT 6.7 ATA Interim Report

E. Heyder, M. J. Jacey, and D. V. Tappan 4 Jun. 1975 26 p refs

(MF51524014)

(AD-A020044; NSMRL-810) Avail: NTIS CSCL 06/19

U.S. Navy diver volunteers were subjected to short (45-minute) exposures to air at 6.7 ATA. The experimental protocol was designed to compare the recoveries from single exposures with those from similar dives employing 3-day inter-dive intervals. Serum and 24-hour urine samples were collected for 5 days prior to and for 7 and 10 respectively after the dives. Serum and urinary minerals, electrolytes, and protein metabolites as well as serum enzymes and urinary steroids were measured.

The overall effects of air at 6.7 ATA and 19 serum parameters was very pronounced 1 hour post-dive. Following a single dive, the response declined sharply to a low after 3 days. This was followed by a second response peak after 5 days and a subsequent gradual decline. Following the 3-day-repeat dives, a secondary peak occurred on the 3rd day following the second dive. The response to the diving stress as indicated by 14 urine parameters showed a small increase on the first two post-dive days followed by a decrease on the third. After a single dive, the consequences of the exposure continued to increase for up to 7-8 days. When a second dive was made on the 3rd day after the initial exposure, a very large response occurred on the 2nd day after the second dive, with a rebound on the 3rd day, and secondary peaks on the 4th and 6th day. These studies support previous observations that effects of hyperbaric exposure continue for several days following pressurization. Repeated exposures within the recovery period alter the pattern of recovery.

Author (GRA)

N76-26859# Flying Personnel Research Committee, London (England).

THE RETENTION OF PROTECTIVE ADAPTATION TO MOTION SICKNESS INDUCED BY CROSS-COUPLED ANGULAR ACCELERATIONS

J. T. Reason and E. Diaz Feb. 1975 26 p refs

(AD-A019294; FPRC-1335) Avail: NTIS CSCL 06/19

Two experiments are reported. In the first, designed to assess the retention of adaptation to repeated exposures of graded cross-coupled angular accelerations, eight young men received eight adaptation sessions in alternate directions of rotation over a total period of 24 weeks. The results indicated a steady build-up of 'savings' of protective adaptation as reflected by the progressive reduction in stimulation required to achieve an operationally-defined level of adaptation. The second experiment examined the relationship between the 'savings' of adaptation on the second of two exposures and the time interval between them. Twenty-five young men were assigned to five equal groups matched for motion sickness history. No decline in savings was observed with increasing time intervals. Finally, an attempt was made to integrate the findings of these two experiments into a general theoretical statement concerning the decay of protective adaptation following both single and repeated exposures to an adapting stimulus. GRA

N76-26860# Flying Personnel Research Committee, London (England).

CATECHOLAMINE, CORTICOSTEROID AND KETONE EXCRETION IN EXERCISE AND HYPOXIA

P. Smith, R. F. Coward, and C. J. Hall May 1975 19 p refs

(AD-A019293; FPRC-Memo-256) Avail: NTIS CSCL 06/19

Four subjects undertook light exercise each working day for two consecutive weeks, during one of which the experiment was carried out under hypoxic conditions. The excretions of adrenaline, noradrenaline and 17-hydroxycorticosteroids (17-OHCS) were measured during the stress and also overnight, and urines were tested for the presence of ketone bodies. The excretion of adrenaline and 17-OHCS in stress was highest on the first day of each week. In general, the excretion of adrenaline was higher throughout the first, as compared with the second, week. These results are considered to be indicative of adaptation to stress. Only noradrenaline showed significantly higher excretion in hypoxia. Throughout the experiment excretion of 17-OHCS during the stress period was below normal levels, suggesting 'retention' of steroids in stress rather than increased adrenocortical activity. However, 17-OHCS excretion tended to be higher during the experimental period and subsequently lower overnight during the hypoxia week. Ketosis occurred in two subjects. In one of these it could be readily related to previous extraneous stress. Excretion of unidentified ketones in overnight urines was sometimes suspected and occurred beyond doubt following gross ketosis. Author (GRA)

N76-26861# Army Research Inst. of Environmental Medicine, Natick, Mass.

METABOLIC ENERGY EXPENDITURE AND TERRAIN COEFFICIENTS FOR WALKING ON SNOW

K. B. Pandolf, M. F. Haisman, and R. F. Goldman Jul. 1975 26 p refs

(DA Proj. 3A7-62758-A-827)

(AD-A019590; USARIEM-M-1-76) Avail: NTIS CSCL 06/19

The ten male subjects each walked at two speeds, 0.67 and 1.12 m/s (1.5 and 2.5 mph) on a level treadmill, and on a variety of snow depths. Energy expenditure increased linearly with increasing depth of footprint depression and was expressed, considering clothed weight, by the regression equation: energy expenditure (W/kg-hor km/hr) = 1.18 + 0.089 depression (cm). At 45 cm footprint depression as compared to a 0 cm depression, energy expenditure increased by a ratio of approximately 5:1. For 0.67 and 1.12 m/s, predicted metabolic rate (M) in watt (W) corresponded to the regression equations, M = 213.56 + 21.480 depression (cm), and M = 484.62 + 20.617 depression (cm), respectively. Although subjects were considered above average in terms of fitness (average vol max = 51.4 ml/kg-min (n = 6)), all terminated walking due to exhaustion at an average footprint depth of 35.0 cm at a walking speed of 1.12 m/s. Practical limits for prolonged snow walking not exceeding approximately 50% vol max were developed with 20 cm being the maximal depth at 0.67 m/s, and 10 cm at 1.12 m/s without snow shoes. At increased footprint depths, limiting factors for snow walking were the increasing lift work, inefficient stooping posture and balancing difficulty. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N76-26862 New Mexico State Univ., University Park.

VISUAL TARGET ACQUISITION AND SEARCH PERFORMANCE Ph.D. Thesis

John Buford Mocharnuk 1976 148 p

Avail: Univ. Microfilms Order No. 76-12638

The effects of information and physical variables on visual search performance and on the ocular activity associated with that performance, are studied. Three experiments were completed using a brief exposure technique. The manipulated variables included memory load, exposure duration, and the physical grouping of information within a display. Several patterns emerged from the data. Stimulus information appeared to have no effect on eye movement measures. Instead, the physical restrictions imposed on the search task were responsible for changes in ocular behavior. However, there was a substantial effect of information on total search performance. The per item search rate increased as the total information in the display increased. This informational effect was interpreted in terms of a variable processing rate hypothesis. Dissert. Abstr.

N76-26863# National Aviation Facilities Experimental Center, Atlantic City, N.J.

DEVELOPMENT OF A PERFORMANCE CRITERION FOR ENROUTE AIR TRAFFIC CONTROL PERSONNEL RESEARCH THROUGH AIR TRAFFIC CONTROL SIMULATION: EXPERIMENT 1: PARALLEL FORM Interim Report, Jan. 1975 - Feb. 1975

Edward P. Buckley, Bernard Goldberg, Richard Rood, Helen Hamilton, Florence Champion, James Talotta, R. Algeo, S. R. Pszczolkowski, Gerard Spanier, Francis Baldwin et al Feb. 1976 40 p refs

(FAA-RD-75-186; FAA-NA-75-40) Avail: NTIS HC $4.00 CSCL 05/9

Small experiments were performed as part of the process of developing a standardized performance criterion for journeyman enroute traffic controllers for the evaluation of potential aptitude tests as to their capacity to predict suitability for entrance into training. The purpose of these first experiments was to seek directions for the construction of different but equally difficult (parallel) forms of the test by using combinations of sector geographic structures and traffic density levels. Two sectors, which differed widely in geographic structure, and three traffic density levels were orthogonally combined to yield six experimental conditions. Six experienced air traffic controllers worked under each of the six conditions in the air traffic control simulator. The results indicate that performance scores were much less

affected by sector structure than by traffic density. Consequently, it was accepted as a guideline for further work that parallel forms can be built on the basis of traffic density level equivalence alone. Author

N76-26864# Franklin McLean Memorial Research Inst., Chicago, Ill.
PROGRESS IN EVALUATION OF HUMAN OBSERVER VISUAL DETECTION PERFORMANCE USING THE ROC CURVE APPROACH
C. E. Metz, S. J. Starr, L. B. Lusted, and K. Rossmann 1975 9 p refs Presented at the 4th Intern. Conf. on Inform. Process. in Scintigraphy, Orsay, France, 15-19 Jul. 1975 Sponsored by ERDA
(CONF-750750-1) Avail: NTIS HC $4.50

Human observer performance in complex detection situations was analyzed. The results of these and similar studies will hopefully contribute toward development of an understanding of the relationships between physical image parameters and human observer decision performance in clinically relevant visual detection tasks. Efforts to develop an objective approach to evaluating the usefulness of diagnostic decisions which have been made on the basis of visual information are described. Applications in the interpretation of radiographs and radionuclide scans are discussed. ERA

N76-26844* Ministry of Health of the USSR, Moscow.
SELECTION OF ASTRONAUTS AND COSMONAUTS
N. N. Gurovskiy, I. I. Bryanov, and Mae Mills Link *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 419-437 refs (For availability see N76-26829 17-52)
CSCL 05I

N76-26845* Ministry of Health of the USSR, Moscow.
TRAINING OF COSMONAUTS AND ASTRONAUTS
N. N. Gurovskiy and Mae Mills Link *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 438-450 refs (For availability see N76-26829 17-52)
CSCL 05I

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N76-26865*# Scientific Translation Service, Santa Barbara, Calif.
WATER FOR THE COSMONAUT
Yu. Ye. Sinyak and S. V. Chizhov Washington NASA Jun. 1976 11 p Transl. into ENGLISH from Khim. Zhizn (USSR), no. 7, Jul. 1975 p 23-26
(Contract NASw-2791)
(NASA-TT-F-15480) Avail: NTIS HC $3.50 CSCL 06K

The problem of water supply for cosmonauts during long-duration space flight is reviewed. After it is shown that water constitutes the major weight in life support systems, natural water regeneration processes are discussed. Soviet and U.S. experiments with water regeneration systems are reviewed and the Salyut-4 regeneration system, which fulfilled one-half of the cosmonaut's drinking needs, is described. Author

N76-26866*# Scientific Translation Service, Santa Barbara, Calif.
LIFE SUPPORT SYSTEMS AND RESEARCH APPARATUS FOR PERFORMING THE KOSMOS-782 SATELLITE EXPERIMENT
B. A. Adamovich, A. A. Zlatorunskiy, A. D. Noskin, V. S. Poleshchuk, V. I. Milyavskiy, V. K. Golov, and V. K. Ovcharov Washington NASA Jun. 1976 7 p Transl. into ENGLISH from an unpublished Russian report
(Contract NASw-2791)
(NASA-TT-F-15491) Avail: NTIS HC $3.50 CSCL 06K

A description is given of the equipment used on the Kosmos-782 satellite. Analysis of the data from the satellite showed that all systems operated normally. Author

N76-26867*# Scientific Translation Service, Santa Barbara, Calif.
THE PRESERVATION OF COOKED DRIED RICE IN THE ALPHA-STATE BY FREEZE-DRYING
J. H. Pyeun, Y. R. Choi, and C. E. Choi Washington NASA Jun. 1976 11 p refs Transl. into ENGLISH of "Dong-kiul-konjo-ae Eui-han Mipan-ae alpha-Hwoa-ae Kwan-ha-ya" The Army Research Report, v. 5, 1966 p 1-4
(Contract NASw-2791)
(NASA-TT-F-17063) Avail: NTIS HC $3.50 CSCL 06H

The effect of freeze-drying on the preservation of cooked and dried rice is examined as the improved means of emergency main food for the army. Temperature, condition of vacuum degree, and drying velocity in freeze-drying process are among the factors considered. Author

N76-26868*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REGENERABLE DEVICE FOR SCRUBBING BREATHABLE AIR OF CO2 AND MOISTURE WITHOUT SPECIAL HEAT EXCHANGER EQUIPMENT Patent Application
Edward H. Tepper, inventor (to NASA) (Hamilton Standard, Windsor Locks, Conn.) Filed 21 May 1976 17 p Sponsored by NASA
(NASA-Case-MSC-14770-1; US-Patent-Appl-SN-688855) Avail: NTIS HC $3.50 CSCL 06K

A device is described which absorbs and adsorbs carbon dioxide and excess moisture in cabin atmospheres. The sorbing material is a polyethyleneimine coating which absorbs and adsorbs impurities at standard temperatures and pressures, but desorbs such impurities at low pressures and standard temperatures. The device is made in a stack of cells consisting of identical layers which are isolated flow-wise and are connected to separate manifolds and valving systems into two separate subsets. One subset scrubs the air until the polyethyleneimine is saturated while the other subset purifies the saturated polyethyleneimine. Since sorption processes liberate heat while the desorption processes require heat, the device also operates a heat exchanger. Aluminum is used to separate the cells from one another and is disposed throughout the polyethyleneimine to assist in the heat transfer. The metal is formed into fins and conducts exothermic energy so well from a sorbing cell to its desorbing neighbors that the cells operate essentially isothermally, maintaining a constant mean average temperature and requiring neither the addition nor the removal of heat from the cabin air. NASA

N76-26869*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
REGENERABLE DEVICE FOR SCRUBBING BREATHABLE AIR OF CO2 AND MOISTURE WITHOUT SPECIAL HEAT EXCHANGER EQUIPMENT Patent Application
Edward H. Tepper, inventor (to NASA) (Hamilton Standard, Windsor Lock, Conn.) Filed 21 May 1976 20 p Sponsored by NASA
(NASA-Case-MSC-14771-1; US-Patent-Appl-SN-688854) Avail: NTIS HC $3.50 CSCL 06K

A device is described which absorbs and adsorbs carbon dioxide and excess moisture in cabin atmospheres. The sorbing material is a polyethyleneimine coating which absorbs and adsorbs impurities at standard temperatures and pressures, but desorbs such impurities at low pressures and standard temperatures. The device is made in a stack of cells consisting of identical layers which are isolated flow-wise and are connected to separate manifolds and valving systems into two separate subsets. One subset scrubs the air until the polyethyleneimine is saturated while the other subset purifies the saturated polyethyleneimine. Since sorption processes liberate heat while the desorption processes require heat, the device also operates a heat exchanger. Foamed aluminum is used to separate the cells from one another and is disposed throughout the polyethyleneimine to assist in the heat transfer. The foamed metal is formed into blocks and conducts exothermic energy so well from a sorbing cell to its desorbing neighbors that the cells operate essentially isothermally, maintaining a constant mean average temperature and requiring neither the addition nor the removal of heat from the stream of cabin air. NASA

N76-26870# Royal Aircraft Establishment, Farnborough (England).

FUNCTIONAL TWO-DIMENSIONAL MANIKINS
H. W. Jeurgens, K. Helbig, and T. Kopka Mar. 1976 13 p refs Transl. into ENGLISH from Ergonomics (London), v. 18, no. 2, 1975 p 185-194 (Original in German)
(RAE-Lib-Trans-1859; BR52161) Avail: NTIS HC $3.50

Two-dimensional manikins are used as tools in designing and assessing workplaces (on a 1:1 scale) in the broadest sense. Models available to date reduce the joints of the human body to fixed axial joints and are therefore incapable of reproducing changes in the shape of the body resulting from movement. A new type of joint in the 'Kieler Puppe' model introduced here for a seated and standing person in profile, and a seated person as seen from above, permits only physiological body postures and reproduces natural body contours in every posture and every postural change. Author

N76-26871*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN ARTIFICIAL LEG EMPLOYING A MECHANICAL ENERGY STORAGE DEVICE FOR HIP DISARTICULATION Patent Application
Wilbur C. Vallotton, inventor (to NASA) Filed 30 Jun. 1976 14 p
(NASA-Case-ARC-10916-1; US-Patent-Appl-SN-701448) Avail: NTIS HC $3.50 CSCL 06B

An artificial leg which includes a trunk socket, a thigh section hingedly coupled to the trunk socket, a leg section hingedly coupled to the thigh section, and a foot section hingedly coupled to the leg section is described. Energy is stored in a mechanical energy storage device during a weight-bearing phase of the walking stride when the user's weight is on the artificial leg, and energy is released during a phase of the normal walking stride, when the user's weight is removed from the artificial leg. The stored energy is released from the energy storage device to pivot the thigh section forwardly about the hinged coupling thereof to the trunk socket. A dash-pot is coupled between the lower end of the thigh section and the foot section for damping flexing of the knee joint after a certain predetermined extent of ankle flexing is achieved to derive a more normal stride and cadence. NASA

N76-26872# European Space Agency, Paris (France).
SAFETY ANALYSIS OF MANNED SYSTEMS
R. C. Kohlheyer 1976 9 p Presented at the European Space Prod. Assurance Symp., Frascati, Italy, 4-6 May 1976
Avail: NTIS HC $3.50

Human safety aspects are considered within the context of manned space flight, in particular Spacelab. The complexity of safety tasks is illustrated, and the contention is underlined that application of simple rules and procedures to the exclusion of reason and experience is perhaps more hazardous in the false confidence they give than in the failures they prevent. ESA

N76-26873# Army Aeromedical Research Lab., Fort Rucker, Ala.
BIO-OPTICAL EVALUATION OF SPECIALIZED EYEWEAR: LASER SAFETY AND DARK ADAPTATION DEVICES Final Report
Wun C. Chiou and David D. Glick Nov. 1975 31 p refs
(AD-A019787; USAARL-76-7) Avail: NTIS CSCL 17/8

This report provides quantitative data and color vision evaluations for several types of goggles. The first two types are laser safety devices and the other three are for dark adaptation purposes. It is found that He-Ne laser safety eyewear conforms to the Army Regulation specification. It is recommended that one type of the safety device be used for only one specific purpose. Furthermore, the laser safety device cannot be used when a detection of a red display or a red light source is required. Results from the dark adaptation devices show that the spectral transmission characteristics possess virtually a common distribution. Author (GRA)

N76-26810* Ministry of Health of the USSR, Moscow.
BAROMETRIC PRESSURE AND GAS COMPOSITION
V. B. Malkin *In* NASA, Washington Found. of Space Biol. and Med., Vol. 2, Bk. 1 1975 p 3-64 refs (For availability see N76-26809 17-52)
CSCL 06K

N76-26830* California Univ., Berkeley.
BASIC DATA FOR PLANNING LIFE-SUPPORT SYSTEMS
Doris Howes Calloway *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 3-21 refs (For availability see N76-26829 17-52)
CSCL 06K

N76-26831* Military Medical Academy (USSR), Leningrad. Lab. of Nutrition.
FOOD AND WATER SUPPLY
I. G. Popov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 22-55 refs (For availability see N76-26829 17-52)
CSCL 06K

N76-26832* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
AIR REGENERATING AND CONDITIONING
B. G. Grishayenkov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 56-110 refs (For availability see N76-26829 17-52)
CSCL 06K

N76-26833* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
CLOTHING AND PERSONAL HYGIENE
A. M. Finogenov, A. N. Azhayev, and G. V. Kaliberdin *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 111-130 refs (For availability see N76-26829 17-52)
CSCL 06K

N76-26834* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
ISOLATION AND REMOVAL OF WASTE PRODUCTS
V. V. Borshchenko *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 131-156 refs (For availability see N76-26829 17-52)
CSCL 06K

N76-26835* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
HABITABILITY OF SPACECRAFT
Yu. A. Petrov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 157-192 refs (For availability see N76-26829 17-52)
CSCL 06K

N76-26836* National Aeronautics and Space Administration, Washington, D.C.
INDIVIDUAL LIFE-SUPPORT SYSTEMS OUTSIDE A SPACECRAFT CABIN, SPACE SUITS AND CAPSULES
Walton L. Jones *In its* Found. of Space Biol. and Med., Vol. 3 1975 p 193-223 refs (For availability see N76-26829 17-52)
CSCL 06K

N76-26837* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
NONREGENERATIVE LIFE-SUPPORT SYSTEMS FOR FLIGHTS OF SHORT AND MODERATE DURATION
B. A. Adamovich *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 227-246 refs (For availability see N76-26829 17-52)
CSCL 06K

N76-26838* National Aeronautics and Space Administration, Washington, D.C.
LIFE-SUPPORT SYSTEMS FOR INTERPLANETARY SPACECRAFT AND SPACE STATIONS FOR LONG-TERM USE
Walton L. Jones *In its* Found. of Space Biol. and Med., Vol. 3 1975 p 247-273 refs (For availability see N76-26829 17-52)
CSCL 06K

N76-26839* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
BIOLOGICAL LIFE-SUPPORT SYSTEMS
Ye. Ya. Shepelev *In* NASA, Wahington Found. of Space Biol. and Med., Vol. 3 1975 p 274-308 refs (For availability see

N76-26829 17-52)
CSCL 06K

N76-26840* Ministry of Health of the USSR, Moscow. Inst. of Biomedical Problems.
PROTECTION AGAINST RADIATION (BIOLOGICAL, PHARMACOLOGICAL, CHEMICAL, PHYSICAL)
P. P. Saksonov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 311-344 refs (For availability see N76-26829 17-52)
CSCL 06R

N76-26843* Military Medical Academy (USSR), Leningrad.
PROTECTION OF CREWS OF SPACECRAFT AND SPACE STATIONS
I. N. Chernyakov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 3 1975 p 395-416 refs (For availability see N76-26829 17-52)
CSCL 06K

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

N76-26874*+ National Aeronautics and Space Administration, Washington, D.C.
PUBLICATIONS OF THE PLANETARY BIOLOGY PROGRAM FOR 1975: A SPECIAL BIBLIOGRAPHY
K. A. Souza, comp. and R. S. Young, comp. Jul. 1976 24 p (NASA-TM-X-74313) Avail: NTIS HC $3.50 CSCL 06C

The Planetary Biology Program of the National Aeronautics and Space Administration is the first and only integrated program to methodically investigate the planetary events which may have been responsible for, or related to, the origin, evolution, and distribution of life in the universe. Research supported by this program is divided into the seven areas listed below: (1) chemical evolution, (2) organic geochemistry, (3) life detection, (4) biological adaptation, (5) bioinstrumentation, (6) planetary environments, and (7) origin of life. The arrangement of references in this bibliography follows the division of research described above. Articles are listed alphabetically by author under the research area with which they are most closely related. Only those publications which resulted from research supported by the Planetary Biology Program and which bear a 1975 publication date have been included. Abstracts and theses are not included because of the preliminary and abbreviated nature of the former and the frequent difficulty of obtaining the latter. Author

N76-26805* Academy of Sciences (USSR), Moscow. Inst. of Microbiology.
BIOLOGICAL EFFECTS OF EXTREME ENVIRONMENTAL CONDITIONS
A. A. Imshenetskiy *In* NASA, Washington, Found. of Space Biol. and Med., Vol. 1 1975 p 271-320 refs (For availability see N76-26799 17-52)
CSCL 06F

N76-26806* Academy of Sciences (USSR), Moscow. Inst. of Biochemistry.
THEORETICAL AND EXPERIMENTAL PREREQUISITES OF EXOBIOLOGY
A. I. Oparin *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 321-367 refs (For availability see N76-26799 17-52)
CSCL 06F

N76-26807* Moscow State Univ. (USSR). Problem Lab. of Space Biology.
SEARCH FOR AND INVESTIGATION OF EXTRATERRESTRIAL FORMS OF LIFE
A. B. Rubin *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 368-402 refs (For availability see N76-26799 17-52)
CSCL 06F

N76-26808* National Aeronautics and Space Administration, Washington, D.C.
PLANETARY QUARANTINE: PRINCIPLES, METHODS, AND PROBLEMS
Lawrence B. Hall *In its* Found. of Space Biol. and Med., Vol. 1 1975 p 403-430 refs (For availability see N76-26799 17-52)
CSCL 06F

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N76-26875 Texas A&M Univ., College Station.
OPTIMAL DESIGN OF FILES FOR TRANSACTION ORIGINATED DATA BASE SYSTEMS Ph.D. Thesis
Kurt Alan Schember 1975 106 p
Avail: Univ. Microfilms Order No. 76-12691

The lack of an existing file design methodology for data base systems is established. A file design procedure for a class of transaction oriented data base systems is then developed. An enumerative algorithm is described. This algorithm involves rearrangement of a data element -- query set matrix to locate clusters of data elements, thereby significantly reducing the number of possible file designs without eliminating optimal designs. The reduced solution space is then systematically searched for the optimal design. Additionally, a programmed solution of the algorithm is presented to demonstrate the utility of the concept. Several sample data bases are described and analyzed. Dissert. Abstr.

N76-26876 Stanford Univ., Calif.
AUTOMATIC GENERATION OF DATABASE DEFINITIONS FOR AN INFORMATION RETRIEVAL SYSTEM Ph.D. Thesis
William Joseph Berman 1976 136 p
Avail: Univ. Microfilms Order No. 76-12979

The choice of database structures in a particular information retrieval system -- the Stanford Public Information Retrieval System (SPIRES) -- is considered with the requirement that this choice be made on the basis of a simple and natural language for describing the data to be stored in the database. A conceptual framework for data description was first developed. While this framework is based on the semantics of data, it includes all of the necessary information for database definition. Second, the range of database definition possibilities in SPIRES was studied and systematized. This made the goal of the process well-defined. Finally, a program which is officially called the 'SPIRES Online Database Definition Consultant' was designed and implemented. The Consultant assists a user in the process of data description and then automatically generates a database definition.
Dissert. Abstr.

N76-26877 Yale Univ., New Haven, Conn.
PARALLEL IMAGE PROCESSING WITH AN OPTICAL-DIGITAL COMPUTER Ph.D. Thesis
David Tai Wai Lee 1975 184 p
Avail: Univ. Microfilms Order No. 76-13619

An optical preprocessing technique for generating spatial masks is investigated theoretically and experimentally. Both the

spectral and the spatial signatures are used in the synthesis of these masks. They can be used in binary logic operations to isolate out certain classes of objects of interest within a scene that are equivalent in some sense. Hence, they are termed Equivalence Class Masks (ECM). A second stage image processing scheme that operates in conjunction with the ECM technique is investigated theoretically and experimentally. The scheme uses the concept of a spectral signature vector and a least squares estimation algorithm to enable the planimetric analysis of color scenes. The presence of noises in the measurement is considered and a solution suggested. This optical digital technique inspires the development of an optical digital computer for use in image processing. Dissert. Abstr.

N76-26878 Kentucky Univ., Lexington.
COMPUTER-AIDED DESIGN OF SAMPLED-DATA CONTROL SYSTEMS VIA COMPLEX-CURVE FITTING Ph.D. Thesis
Kuldip Singh Rattan 1975 157 p
Avail: Univ. Microfilms Order No. 76-14275

A method for the design of sampled-data control systems has been presented dealing with the development of a technique for the design of a digital controller so that the response of the designed system matches that of the continuous model for all possible inputs. The transfer function of the continuous model is obtained from the given performance specifications. Once the transfer function of the continuous model is known, the synthesis of a digital controller is carried out by matching the frequency response of the sampled-data control system to that of the continuous model. Numerical examples are considered to illustrate the versatility of the above synthesis procedure. Comparative analysis was carried out between the developed procedure and the classical synthesis techniques. The results of these design examples indicate that the design method developed in this study is powerful, simple to use and gives superior results compared to other existing design techniques. Dissert. Abstr.

N76-26879# Oak Ridge National Lab., Tenn.
BIOMEDICAL COMPUTING TECHNOLOGY INFORMATION CENTER (BCTIC). FOCUS FOR THE SHARING OF COMPUTER PROGRAMS AND TECHNOLOGY IN BIOMEDICINE
B. F. Maskewitz, W. J. McClain, and R. L. Henne 1975 12 p refs Presented at the 5th Natl. Conf. on Soc. of Computer Med., Chicago
(Conf-751110-1) Avail: NTIS HC $4.00

The Biomedical Computing Technology Information Center, Oak Ridge National Laboratory, Oak Ridge, Tennessee, is organized to make its information quickly available to those who telephone or come to visit. The aim of the Center is to provide the most up-to-date information possible concerning computer applications in medicine and other biological studies. ERA

N76-26880# Gesellschaft fuer Kernforschung m.b.H., Karlsruhe (West Germany).
MICROPROCESSORS AND MULTIPROCESSOR NETWORKS
H. Birck, G. Faerber, H. Halling, D. Heger, E. Holler, M. Patz, H. Steusloff, and H. Walze Aug. 1975 122 p refs In GERMAN Presented at the PDV Workshop on Microprocessors and Multiprocessor Networks, Munich, 6-7 Dec. 1974
(KFK-PDV-50; Conf-741258) Avail: ERDA Depository Libraries HC $6.50

The essentials of single papers presented at the PDV workshop on 'Microprocessors and Multiprocessor Networks' held on December 5 and 6, 1974, in Munich are given. The most important features of microprocessors and microcomputer components available today are listed and briefly described. In addition, typical application schemes are presented. Author (ERA)

N76-26881# European Organization for Nuclear Research, Geneva (Switzerland).
TERMINALS FOR THE INTERACTIVE INPUT AND EDITING OF BIBLIOGRAPHIC RECORDS ON THE PDP-11 COMPUTER IN THE CERN LIBRARY
A. VanPraag 13 Nov. 1975 64 p refs
(CERN-75-15) Avail: ERDA Depository Libraries HC $5.50

As part of the Library Mechanization Project, special computer terminals were designed and built for the input and display of a wide range of characters, including Greek letters and mathematical symbols. Each terminal consists of a novel 7-bank keyboard together with two Tektronix 611 storage-tube displays, and there are four terminals connected to a PDP-11/20 computer. After an outline of the hardware for the terminal system, the computer interface, display driver, matrix character generator, keyboard, programable clock, and address comparator are described. More detailed descriptions of the circuits, the signal formats, and a complete set of schematic diagrams are given as appendices. Author (ERA)

N76-26882# California Univ., Berkeley.
HARDWARE AND SYSTEM ARCHITECTURE FOR A VERY LARGE DATABASE
R. Healey and B. Heckman Aug. 1975 4 p refs Presented at the Conf. on Very Large Databases, Framingham, Mass.
(Contract W-7405-eng-48)
(LBL-4233; Conf-750974-1) Avail: NTIS HC $4.00

Practical experience in structuring a large amount of data is described. The architecture for structuring the data base for online devices and making the retrieval as efficient as possible is explained. ERA

N76-26883# Argonne National Lab., Ill.
AESOP 13, EXPERIENCES WITH PERFORMANCE MEASUREMENT AT ARGONNE NATIONAL LAB
D. R. Snider Oct. 1975 26 p Presented at the 13th AESOP Meeting, Chicago, 22-24 Oct. 1975
(Contract W-31-109-eng-38)
(CONF-751011-3) Avail: NTIS HC $5.00

The central computing facility at ANL is very briefly described. Attention is then directed to system performance evaluation activities of the systems group. The primary aim is to measure the operational characteristics of the computer system and apply the results to the system so as to improve its efficiency. Emphasis is on the NEUROTRON hardware monitor and some of its applications. ERA

N76-26884# Navy Personnel Research and Development Center, San Diego, Calif.
USE OF AN INTERACTIVE GENERAL-PURPOSE COMPUTER TERMINAL TO SIMULATE TRAINING EQUIPMENT OPERATION Technical Report, Jan. 1974 - Jun. 1975
George F. Lahey, Alice M. Crawford, and Richard E. Hurlock Nov. 1975 35 p refs
(AD-A019514; NPRDC-TR-76-19) Avail: NTIS CSCL 05/9

The research examined a computer-based simulation of operational equipment as a potentially cost-effective training mode. CAI materials simulating use of the Simpson 260-1 multimeter were presented to experimental students at PLATO IV terminals where the frontal topography and external operations of the multimeter were simulated by computer graphics. Control students learned the material from self-paced module booklets. Comparisons of the two groups revealed no significant difference in written or performance tests, but experimental students spent more time in training. It was concluded that simulations of equipment on an interactive general-purpose computer terminal, such as the PLATO IV, are practical and could provide an alternative to the purchase of special training equipments. GRA

N76-26885# Stanford Univ., Calif. Dept. of Computer Science.
DEPTH PERCEPTION IN STEREO COMPUTER VISION
Clark Thompson Oct. 1975 18 p
(Contract DAHC15-73-C-0435; ARPA Order 2494)
(AD-A019663; SU-STAN-CS-75-521; SU-AIM-26815) Avail: NTIS CSCL 14/5

This report describes a stereo vision approach to depth perception; the author has built upon a set of programs that decompose the problem in the following way: (1) production of a camera model: the position and orientation of the cameras in 3-space; (2) generation of matching point-pairs: loci of corresponding features in the two pictures; (3) computation of the point in 3-space for each point-pair; and (4) presentation of the resultant depth information. Author (GRA)

N76-26886# Computer Sciences Corp., Phoenix, Ariz.
RADCOLS COMPUTER SIMULATION MODEL OVERALL SYSTEMS SPECIFICATION. VOLUME 1 Final Technical Report, Jun. 1974 - Jun. 1975
Vthor Braun Sep. 1975 340 p refs
(Contract F30602-74-C-0281)
(AD-A019050; RADC-TR-75-230-Vol-1) Avail: NTIS CSCL 09/2

The RADCOLS (Rome Air Development Center on Line Simulator) model is a system which simulates a Honeywell Information System 600 or 6000 computer complete with its GCOS (General Comprehensive Operating System) Operating System. The model executes on a HIS 600/6000 System under GCOS and is written in SIMSCRIPT 2, 5. The primary purpose of the RADCOLS model is to provide an experimenter with a tool by which he may reasonably predict the effect of proposed hardware, software and work load changes. Representation of the GCOS multi-dimensional philosophy has been the primary design goal of RADCOLS. The experimenter is permitted to introduce input to the model which portrays a specified work load on the system. Job generation is accomplished within the model via distribution factors submitted as inputs under each (Local Batch, Remote Batch, and TSS) work load category. The model has been designed to generate four specific report types: Facility Utilization, Process Delay, Queu Beliovior, and Task Turnaround. GRA

N76-26887# Computer Sciences Corp., Phoenix, Ariz.
RADCOLS COMPUTER SIMULATION MODEL OVERALL SYSTEMS SPECIFICATION. VOLUME 2: FLOW CHARTS Final Technical Report, Jun. 1974 - Jun. 1975
Vthor Braun Sep. 1975 305 p refs
(Contract F30602-74-C-0281)
(AD-A019051; RADC-TR-75-230-Vol-2) Avail: NTIS CSCL 09/2

For abstract, see N76-26886.

N76-26888# Computer Sciences Corp., Phoenix, Ariz.
RADCOLS COMPUTER SIMULATION MODEL OVERALL SYSTEMS SPECIFICATION. VOLUME 3: USERS MANUAL Final Technical Report, Jun. 1974 - Jun. 1975
Vthor Braun Sep. 1975 108 p refs
(Contract F30602-74-C-0281)
(AD-A019052; RADC-TR-75-230-Vol-3) Avail: NTIS CSCL 09/2

The objective of this Users Manual for the RADCOLS Computer Simulation Model is to provide the user personnel with the information necessary to effectively use the model. This manual is applicable to three classes of users: experimenters, model developers, and model maintainers. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N76-26889 Southwestern Louisiana Univ., Lafayette.
VIRTUAL MACHINE MULTIPROGRAMMING AND SECURITY Ph.D. Thesis
Leslie Joseph Waguespack, Jr. 1975 181 p
Avail: Univ. Microfilms Order No. 76-10637

Four studies are presented: (1) an examination of the necessary conditions for multiprogramming, (2) a definition of computer system security, (3) an examination of the design of a secure multiprogrammable machine, and (4) an examination of the relation between multiprogramming processes and multiprogramming interpreters. Multiprogramming can exist in an environment which can support concurrent processing and process separation. Concurrent processing and process separation may be defined in terms of resource management of transformational and storage resources. Techniques of partitioning such resources realize separation and security in a computer system. An operating system archetype kernel, the nucleus, is proposed as the control component of an operating system. Virtual machines (an alternate term for processes) are examined to relate the security and multiprogramming characteristics to interpreter support. Dissert. Abstr.

N76-26890 Texas A&M Univ., College Station.
A HIGH LEVEL LANGUAGE IMPLEMENTATION OF THE COMMON FEATURES OF DATA BASE DEFINITIONS Ph.D. Thesis
Jimmie Charles Rhea Forehand 1975 122 p
Avail: Univ. Microfilms Order No. 76-12666

A high level language (GDBD - Generalized Data Base Definition) is presented for hierarchical relationships, network relationships, and data field definitions which, with a proper translator, can be used to generate data base definitions. The hierarchical relationships are specified by the production notation of formal languages. A notation for the many-to-one feature of network relationships was specified which follows the hierarchical path of the many, and points to the one. The data field definitions are defined as named n-tuples where the name relates the data field to the hierarchical definition and positional parameters define the specific features of the data field. To test the GDBD language three test data bases were designed. Hierarchical relationships and data field definitions for each of the three data bases are presented. Dissert. Abstr.

N76-26891 Georgia Inst. of Tech., Atlanta.
DEVELOPMENT OF CONTROLLED COMPUTATIONAL EXPERIMENTS ON INTEGER LINEAR PROGRAMMING PROCEDURES Ph.D. Thesis
Benjamin Wei-Yuh Lin 1975 180 p
Avail: Univ. Microfilms Order No. 76-12618

A framework is developed for comparing all integer linear programming procedures. Several ILP problem characteristics are suspected to greatly affect algorithm performance and thus become nuisance parameters to the algorithm developers. Examples are the number of integer variables, the number of constraints, the determinant of the optimal linear programming basis, and the density of nonzero entries in the constraints. An ideal framework for comparing algorithms is to be able to control the settings of these nuisance factors and at least partially eliminate their effects. An outline of conducting a computational study of ILP procedures in such a framework is developed. Dissert. Abstr.

N76-26892 Pennsylvania Univ., Philadelphia.
STRUCTURING A PATTERN SPACE, WITH APPLICATIONS TO LEXICAL INFORMATION AND EVENT INTERPRETATION Ph.D. Thesis
Stanley Joshua Rosenschein 1975 194 p
Avail: Univ. Microfilms Order No. 76-12330

A formalism is presented for structuring a set of patterns such as might be used in event interpretation and the representation of definitional information for lexical items. The formalism makes use of a lattice (generated by the patterns, or 'schemata') in which the relation 'less-than-or-equal-to' and the operations 'least upper bound' and 'greatest lower bound' can be viewed as having cognitive and linguistic correlates. Special attention is paid to making the pattern space rich enough to handle interesting domains like the 'speech acts' and the associated verbs of 'saying.' A computer system was implemented to demonstrate the practicality of several of the key points. The formalism is used to provide internal criteria for when a partial match is to be considered successful. Dissert. Abstr.

N76-26893 Northwestern Univ., Evanston, Ill.
MECHANICAL LANGUAGE GENERATION IN A COMPUTER GRAPHICS ENVIRONMENT Ph.D. Thesis
Gregory John Suski 1975 281 p
Avail: Univ. Microfilms Order No. 76-12383

The design of an applications language generator which produces special purpose languages which best satisfy the requirements of a given user or set of users with specific applications is considered. User preferences and needs are stated in terms of the relative importance of a number of language characteristics as opposed to detailed technical specifications of language features. The primary objective can be viewed as the removal of the language designer(s) and implementor(s) from the actual language generation process by means of computer controlled language design and generation from characteristic

specifications. Research goals include the development of suitable characteristics and feature selections, feature determination from characteristic specifications, language evaluation techniques and applications, instructional materials for mechanically generated languages, and techniques of implementation. Dissert. Abstr.

N76-26894 Yale Univ., New Haven, Conn.
AMPL: A PROGRAMMING LANGUAGE FOR MANUSCRIPT PREPARATION SYSTEMS Ph.D. Thesis
James Edward Sustman 1975 317 p
Avail: Univ. Microfilms Order No. 76-13753

The advent of high resolution dot raster printers has created a need for a special language for the definition of manuscript preparation (MP) systems. To meet this need, the programing language AMPL (A Manuscript Preparation Language) was developed, incorporating data and control structures specifically appropriate to the MP process. The general problem of manuscript preparation was studied, and a model developed which views the actions performed in an MP system as a set of communicating processes. The features of the AMPL language include the ON...DO... statement as the primary control mechanism, the chunk (a tree representation of a formated piece of text) as the main data structure, and a syntax-driven recognizer which processes both the AMPL program and the text file to be formated, allowing the run-time definition of commands and the use of AMPL expressions as the arguments of commands. Dissert. Abstr.

N76-26895 Wisconsin Univ., Madison.
AN ALGEBRAIC MODEL OF PROGRAMMING LANGUAGE SEMANTICS Ph.D. Thesis
Jerry H. Shelton 1975 101 p
Avail: Univ. Microfilms Order No. 76-6106

The problem of formulating a practical and understandable model of programming language semantics was investigated. The language presented is block-structured and has arithmetical and logical expressions, stores, conditionals, iteratives, environments, and parameterless subprograms. The modelling of the semantics of any program is divided into three distinct parts: translation, loading, and running. In the translation phase, a program is mapped into an intuitively semantically equivalent binary tree-structured program. The loading phase models are loading the translated program into addressable storage and storage allocation for all variables appearing in the program. Several other semantic necessities, such as a stack, are introduced at this time. Some of the elements of an intuitive proof of the correctness of the model are presented, and the concept of a 'structure-preserving' map, introduced to effect translation, is shown to be readily extendable to handle constructs which are semantically context-sensitive. Dissert. Abstr.

N76-26896*# Duke Univ., Durham, N.C. Dept. of Computer Science.
DEVELOPMENT OF A METHODOLOGY FOR CLASSIFYING SOFTWARE ERRORS Final Technical Report, 1 Jan. - 30 Jun. 1976
Susan L. Gerhart 2 Jul. 1976 93 p refs
(Grant NsG-1267)
(NASA-CR-148212) Avail: NTIS HC $5.00 CSCL 09B

A mathematical formalization of the intuition behind classification of software errors is devised and then extended to a classification discipline: Every classification scheme should have an easily discernible mathematical structure and certain properties of the scheme should be decidable (although whether or not these properties hold is relative to the intended use of the scheme). Classification of errors then becomes an iterative process of generalization from actual errors to terms defining the errors together with adjustment of definitions according to the classification discipline. Alternatively, whenever possible, small scale models may be built to give more substance to the definitions. The classification discipline and the difficulties of definition are illustrated by examples of classification schemes from the literature and a new study of observed errors in published papers of programming methodologies. Author

N76-26897# Weapons Research Establishment, Salisbury (Australia).
POWIT: A PROGRAM FOR SOLVING NON-LINEAR ALGEBRAIC EQUATIONS
C. A. J. Fletcher Jun. 1975 49 p refs
(WRE-TN-1431(WR/D)) Avail: NTIS HC $4.00

Methods for solving general nonlinear algebraic equations, by minimizing a sum of squared residuals, are reviewed. One method, based on Powell's (1965) algorithm, is described in detail. This method has been incorporated into a computer program, subroutine POWIT, which is written in FORTRAN 4 to suit an IBM 7090; a listing is included. Essentially the same code has been used on a CDC 6400, a CDC 6600 and a CDC 7600. POWIT is suitable for solving equations with up to 20 unkowns and is also applicable to situations where the algebraic relations are not given explicitly but result from, say, the integration of ordinary differential equations. Numerical results are given for the application of POWIT to four 'standard' test problems and to oblique shock reflection and the results indicate that POWIT is stable and considerably faster than any other method available. Author

N76-26898# Los Alamos Scientific Lab., N.Mex.
PERFORMANCE OF MEASUREMENT TOOLS AND EVALUATION OF SCIENTIFIC SOFTWARE
L. E. Rudsinski, K. J. Melendez, L. W. Fullerton, A. Marusak, and F. McGirt 1975 14 p ref Presented at the 13th AESOP Meeting, Chicago, 22 Oct. 1975
(Contract W-7405-eng-36)
(LA-UR-75-1990; Conf-751011-2) Avail: NTIS HC $4.50

In early 1971, the usual interest of the Los Alamos Scientific Laboratory (LASL) in efficient use of computers was given special emphasis. The development of performance measurement tools and establishment of a computer program optimization project were the direct result of this concern. These experiences led to the design and implementation of new performance tools that will enable evaluation of both the program and the algorithm. The design, implementation, and use of these tools are discussed. Author (ERA)

N76-26899# Los Alamos Scientific Lab., N.Mex.
STRUCTURE-FORMERS IN PROGRAMMING LANGUAGES
J. B. Morris 1975 11 p refs Presented at the 3d ACM Sigact-Sigplan Symp. on Principles of Programming Languages, Atlanta, 19 Jan. 1976
(Contract W-7405-eng-36)
(LA-UR-75-1653; Conf-760103-1) Avail: NTIS HC $4.50

The language feature of the structure former is isolated, and attention is drawn to it as a language feature in its own right. Structure formers are discussed within the framework of the model programming language, a language under development, primarily for the purpose of studying data abstraction. ERA

N76-26900# Los Alamos Scientific Lab., N.Mex.
ALGORITHM FOR THE RECOGNITION OF TYPED TWO-DIMENSIONAL MATHEMATICAL EXPRESSIONS
M. B. Wells Nov. 1975 29 p refs
(Contract W-7405-eng-36)
(LA-6138-MS) Avail: NTIS HC $4.00

An algorithm is given which translates two dimensional mathematical expressions such as subscripting and displayed division that were prepared using a keyboard input device into a string form suitable for input to a classical compiler. The algorithm allows reasonably general forms, yet is sufficiently simple to be practically applicable today. It may be written as a preprocessor to an existing compiler in order to improve the readability of an existing language. The algorithm is presented in a version of the Madcap language, a language which itself allows two dimensional constructions. ERA

N76-26901# Los Alamos Scientific Lab., N.Mex.
SUBCYCLING OF CONTROL CODES AND MESH COMPUTATIONS
C. E. Lee Nov. 1975 11 p refs
(Contract W-7405-eng-36)
(LA-6131-MS) Avail: NTIS HC $4.00

Several methods of subcycling coupled codes and mesh cell calculations are investigated for time dependent problems. The probability P(x) of a method running $1/x$, $0 < x < 1$ times faster than the locked-in mode is estimated. In all cases examined it is found that significant computer time savings (factors of

approximately 3 to 10) can be realized by using subcycling of codes and/or mesh cells. Author (ERA)

N76-26902# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
SOFTWARE PERFORMANCE AND EVALUATION: MIXED APPLICATIONS
H. C. Honeck 1975 8 p Presented at the 13th AESOP Meeting, Chicago
(Contract AT(07-2)-1)
(DP-MS-75-108; Conf-751011-4) Avail: NTIS HC $4.50

The importance of performance factors other than hardware utilization in the optimization of software performance is addressed. The comments apply to both business systems and production scientific systems, but not to research scientific systems. It is realized that many performance factors cannot be measured and that value judgments must be made; nevertheless, performance evaluation must be done. Cost reduction procedures and the influence of human factors on computer systems performance are discussed. ERA

N76-26903# Oak Ridge National Lab., Tenn.
INTERACTIVE DIFFERENTIAL EQUATIONS MODELING PROGRAM
B. W. Rust and J. B. Mankin Jan. 1976 121 p refs Sponsored in part by NSF
(Contract W-7405-eng-26)
(EDFB-IBP-74-2) Avail: NTIS HC $7.00

An interactive program was developed with the primary goal of allowing an ecologist with minimal experience in either mathematics or computers to develop a system model. It has also been used successfully by systems ecologists, engineers, and mathematicians. This program was written in FORTRAN for the DEC PDP-10, a remote terminal system at Oak Ridge National Laboratory. However, with relatively minor modifications, it can be implemented on any remote terminal system with a FORTRAN IV compiler, or equivalent. This program may be used to simulate any phenomenon which can be described as a system of ordinary differential equations. The program allows the user to interactively change system parameters and/or initial conditions, to interactively select a set of variables to be plotted, and to model discontinuities in the state variables and/or their derivatives. One of the most useful features to the non-computer specialist is the ability to interactively address the system parameters by name and to interactively adjust their values between simulations. Author (NSA)

N76-26904# Science Research Council, Chilton (England).
SYSTEM SOFTWARE FOR EXPERIMENTAL APPLICATIONS ON A GEC4080
B. J. Charles and D. Maden Sep. 1975 11 p Presented at Conf. on On-Line Computers, London, Sep. 1975
(RL-75-154; Conf-7509109-1) Avail: ERDA Depository Libraries HC $3.50

A general purpose message switching system was developed at the Rutherford Laboratory for use on GEC4080's in conjunction with the manufacturer's disc based operating system, DOS. Particular applications of the system are in on-line data acquisition from a nuclear physics experiment and in the on-line monitoring of a linear accelerator. Both applications use CAMAC in the interfacing between the experimental apparatus and the computer. The main features of the system and the way in which these features are used in a particular example of data acquisition are described. Author (NSA)

N76-26905# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Science Research Group.
GOAL PROGRAMMING AND MULTIPLE OBJECTIVE OPTIMIZATIONS, PART 1
A. Charnes and W. W. Cooper Nov. 1975 52 p refs
(Contracts N00014-75-C-0569; N00014-75-C-0621; NR Proj. 047-021; NR Proj. 047-048)
(AD-A019549; RR-381-Pt-1) Avail: NTIS CSCL 12/1

This is Part I of a survey of recent developments in goal programming and multiple objective optimizations. In this part, attention is directed to goal programming with emphasis on the author's own work (with others) in a variety of applications. This includes goal and goal interval programming, as well as characterizations which make it possible to obtain alternate representations and explicit solutions from special structural properties. Possibilities for various goal functionals are explored and delineated. One class of examples is developed in detail and an algorithm is supplied which utilizes sequence of ordinary linear programming problems to solve certain nonlinear and non-convex problems involving maxima of ratios of linear forms. Author (GRA)

62 COMPUTER SYSTEMS

Includes computer networks.

N76-26906# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
COMMUNICATION BETWEEN PROCESSES [KOMMUNIKATION ZWISCHEN PROZESSEN]
G. Buehler Jul. 1975 33 p refs In GERMAN; ENGLISH summary
(Rept-230) Avail: NTIS HC $4.00

The known methods of communication between concurrent processes of a computer system are summarized. The problems of synchronization and mutual exclusion are included. Author (ESA)

63 CYBERNETICS

Includes feedback and control theory.
For related information see also *54 Man/System Technology and Life Support.*

N76-26907# Naval Postgraduate School, Monterey, Calif.
APPLICATION OF THE COMPUTER FOR REAL TIME ENCODING AND DECODING OF CYCLIC BLOCK CODES M.S. Thesis
Nizamettin Cetinyilmaz Dec. 1975 86 p refs
(AD-A021818) Avail: NTIS CSCL 09/4

This is concerned with cyclic block codes which can be used for the detection and correction of errors in a transmitted message which are produced by various types of noise. Computer programs were developed and used for the actual encoding and decoding process. Advantages of using the computer as against using various types of dedicated hardware is demonstrated. Two different methods of decoding are presented: the minimum distance decoder and the syndrome method decoder. Pseudo random noise sequences were also generated by computer program and used to simulate noise disturbance of the encoded transmitted message. Codes of several rates and with varying degrees of simulated channel noise were studied and compared with respect to the probability of error. It is shown how these methods can materially help in choosing the best code for a given noisy channel, consonant with other specified parameters for message transmission. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N76-26908 Pennsylvania Univ., Philadelphia.
DERIVATIONS IN C*-ALGEBRAS Ph.D. Thesis
Dong Pyo Chi 1975 50 p
Avail: Univ. Microfilms Order No. 76-12257

Unbounded derivations in C*-algebras are studied with particular emphasis on the closability of a derivation and the domain of a closed derivation. It is shown that a derivation delta of a C*-algebra is closable if the domain of delta* contains a faithful state. The following theorem is also proved. Let delta be a densely defined closed derivation in a C*-algebra and A = A* is a member of D delta. If f is 4-time continuously differentiable on a closed interval containing the spectrum of A, then f(A) is

member of D. Spectral theory is used to prove the above theorem. Dissert. Abstr.

N76-26909 Stanford Univ., Calif.
RELATIONS BETWEEN SOME HIERARCHIES OF ORDINAL FUNCTIONS AND FUNCTIONALS Ph.D. Thesis
Richard William Weyhrauch 1976 68 p
Avail: Univ. Microfilms Order No. 76-13091

A new hierarchy of ordinal function is introduced that is generated by the unlimited iteration of the autonomous closure relation to any given procedure for introducing large ordinals. The notion of repleteness is extended to long sequences of functions which preserve number classes. A result is that repleteness is preserved under extension by arbitrarily long sequences of iterations of the autonomous closure process. Dissert. Abstr.

N76-26910 Nebraska Univ., Lincoln.
THE GRAVITATIONAL FIELD OF THIN SHELLS WITH PLANE OR CYLINDRICAL SYMMETRY Ph.D. Thesis
Terry Lee Anderson 1975 158 p
Avail: Univ. Microfilms Order No. 76-13316

New solutions are given for spaces with plane and cylindrical symmetry. A new solution is obtained for static thin planes matter with non-isometric stress. Specific solutions are given for a single plane and a pair of identical planes. A superposition principle is presented which reduces the problem of obtaining the solution for a family of N planes to solving N simultaneous linear algebraic equations. It is shown that most planes must have very large negative stress to be static. It is also shown that all solutions possess one or two physical singularities where the Riemann tensor diverges at a finite proper distance from the source. The junction conditions for the gravitational field across a thin counter-rotating cylindrical shell and the equations of motion for such a shell are given. A new approach to the solution of the field equations for such a shell is presented in terms of an integral equation which reduces the problem to solving two coupled one-dimensional Volterra integral equations. Dissert. Abstr.

N76-26911 Texas A&M Univ., College Station.
SOME PROBLEMS IN MULTIVARIATE ANALYSIS Ph.D. Thesis
Patricia Lee Murphree Smith 1975 120 p
Avail: Univ. Microfilms Order No. 76-12694

Three problems in multivariate analysis were considered. Exact, approximate, and numerical solutions are given in various instances. First, the exact upper percentage points are given for the distribution of the studentized bivariate range for small samples, and Monte Carlo studies are used to assess the power of the test for detecting outliers using conservative percentage points which are given for moderate sized samples. Second, a maximum likelihood test of the hypothesis of the equality of the variance-covariance matrices of two normally distributed correlated vectors X and Y is given for the case when the matrix Cov(X, Y) is symmetric. Third, several methods are investigated empirically for the optimal selection of groups of variables by considering only the sample regression coefficients (or statistics derived from them) of the independent variables when the dependent variable is regressed on all of them together. Dissert. Abstr.

N76-26912 Texas A&M Univ., College Station.
A FINITE ELEMENT METHOD FOR NONLINEAR DYNAMIC ANALYSIS USING A MODAL TRANSFORMATION MATRIX Ph.D. Thesis
Robert Arthur Wilke 1975 153 p
Avail: Univ. Microfilms Order No. 76-12708

A solution procedure is developed and evaluated for the solution of nonlinear dynamic structural problems. The nonlinear equations of motion are written using the finite element method with geometric nonlinearities and moderate rotations. The natural frequencies and mode shapes of the free vibration form of the equations are calculated and the mode shapes used to transform the equations of motion to another orthogonal coordinate system. In the transformed form the equations are uncoupled and may be integrated directly. This solution yields the displacements in the transformed coordinate system; these displacements are returned to the physical basis and used to evaluate the nonlinear terms for the next time. The process is repeated over the desired time range. The solution method is applied first to a simple geometrically nonlinear beam problem and then to a shell of revolution that has highly nonlinear response to the point load at its apex. Dissert. Abstr.

N76-26913 Columbia Univ., New York.
SPHERICAL FUNCTIONS ON GENERAL LINEAR GROUPS OVER FINITE FIELDS Ph.D. Thesis
Michael Joseph Devaney 1975 127 p
Avail: Univ. Microfilms Order No. 76-12735

The spherical functions on a finite group in two cases Z prime union GL (2,a) and Z union GL (3,q) where Z prime and Z are the respective lower triangular unipotent subgroups are computed. The basic properties of spherical functions are reviewed. The action of a subgroup H on G by conjugation partitions G into orbits, called the H classes of G. Spherical functions are H class functions, that is, they are constant on the H classes of G. In fact, they span the center of the algebra [G] to the H power of H class functions on G. By deriving formulas for the dimensions of both [G] to the H power and its center it is shown that [G] to the H power is commutative if and only if all spherical functions of H union G are linear (having degree 1). The spherical functions of GL(2,q) and GL(3,q) are computed. The necessary information on the conjugacy classes and irreducible characters of GL(2,q) and GL(3,q) is given. Dissert. Abstr.

N76-26914 Pittsburgh Univ., Pa.
A FINITE ELEMENT THAT SATISFIES NEUMANN BOUNDARY CONDITIONS EXACTLY Ph.D. Thesis
Juan Carlos HeinrichEbensperger 1975 144 p
Avail: Univ. Microfilms Order No. 76-14142

The finite element method is used to solve elliptic partial differential equations with Dirichlet, Neumann and mixed boundary conditions. Blending function interpolation is used to construct rectangular elements that match all boundary data exactly, and the Ritz method is used to obtain approximations to the solution. The convergence of the method in the energy norm is established and the scheme is compared with the finite element method using standard bilinear elements. Coordinate transformation techniques are incorporated to solve problems in curvilinear domains. The effect on the functional of forcing the admissible functions to satisfy the natural boundary conditions is analyzed and proven to be asymptotically an order of magnitude less than the effect of matching the Dirichlet conditions. Dissert. Abstr.

N76-26915 Yale Univ., New Haven, Conn.
ON THE EFFICIENT SOLUTION OF SPARSE SYSTEMS OF LINEAR AND NONLINEAR EQUATIONS Ph.D. Thesis
Andrew Harry Sherman 1975 207 p
Avail: Univ. Microfilms Order No. 76-13692

The efficient solution by Gaussian elimination of large, sparse, symmetric positive definite systems of linear equations is presented. The costs of an efficient implementation of sparse symmetric Gaussian elimination are developed and analyzed, and the efficient use of direct methods for sequences of sparse linear systems, specifically as they might arise in the solution of nonlinear equations is considered. The implementation of sparse symmetric Gaussian elimination differs from previous implementations. A new storage scheme is employed for sparse matrices which take full advantage of both the available symmetry in the matrices and the regular way in which the zeroes fill in, or become nonzero, during the computation. Dissert. Abstr.

N76-26916 Wisconsin Univ., Madison.
TOPICS IN TIME SERIES ANALYSIS Ph.D. Thesis
Johannes Ledolter 1975 236 p
Avail: Univ. Microfilms Order No. 76-6096

Great attention has been paid to exponential smoothing procedures. The relationship between exponential smoothing techniques and ARIMA models is investigated. It is shown that exponential smoothing procedures provide optimal forecasts (in terms of minimizing the mean squared forecast error) only if the underlying process is a member of a particular narrow subclass of ARIMA models with severe restrictions among its parameters. It is shown that: (1) the autoregressive operator in the implied

ARIMA model is automatically decided by the choice of fitting functions of exponential smoothing procedure; (2) the moving average part is determined by the form of the autoregressive operator and the smoothing constant beta of the exponential smoothing technique which is (3) arbitrarily assumed to be known and chosen between .7 and .9. Dissert. Abstr.

N76-26917 Wisconsin Univ., Madison.
ON THE ASYMPTOTIC BEHAVIOR OF SOLUTIONS OF SEMI-LINEAR PARABOLIC PARTIAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Kai-Nan Chueh 1975 67 p
Avail: Univ. Microfilms Order No. 76-6074

The behavior of solutions of semi-linear parabolic partial differential equations was investigated. A scalar equation was studied as well as the Nagumo equation. The scalar equation can be applied to burning theory, gas dynamics and population genetics; the Nagumo equation is a simplified version of the Hodgkin-Huxley equation. The main technique is used to consider the solutions as one-parameter curves in phase space. The properties of the curves were examined using the maximum principle to compare those curves with orbits of the associated ordinary differential equation satisfied by traveling wave solutions. For the scalar equation, it is proved that derivatives of solutions are uniformly bounded, and one of the traveling waves is stable. For the Nagumo equation, a compact positively invariant region is found, which is very useful if one tries to apply index theory on the semi-flow of solutions. Dissert. Abstr.

N76-26918*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOLUTION OF LINEAR SYSTEMS BY A SINGULAR PERTURBATION TECHNIQUE
Mark D. Ardema May 1976 22 p refs
(NASA-TM-X-73141; A-6622) Avail: NTIS HC $3.50 CSCL 12A

An approximate solution is obtained for a singularly perturbed system of initial valued, time invariant, linear differential equations with multiple boundary layers. Conditions are stated under which the approximate solution converges uniformly to the exact solution as the perturbation parameter tends to zero. The solution is obtained by the method of matched asymptotic expansions. Use of the results for obtaining approximate solutions of general linear systems is discussed. An example is considered to illustrate the method and it is shown that the formulas derived give a readily computed uniform approximation. Author

N76-26919*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
THE ADAMS FORMULAS FOR NUMERICAL INTEGRATION OF DIFFERENTIAL EQUATIONS FROM 1ST TO 20TH ORDER
James C. Kirkpatrick May 1976 37 p ref
(NASA-TM-X-58182; JSC-09379) Avail: NTIS HC $4.00 CSCL 12A

The Adams Bashforth predictor coefficients and the Adams Moulton corrector coefficients for the integration of differential equations are presented for methods of 1st to 20th order. The order of the method as presented refers to the highest order difference formula used in Newton's backward difference interpolation formula, on which the Adams method is based. The Adams method is a polynomial approximation method derived from Newton's backward difference interpolation formula. The Newton formula is derived and expanded to 20th order. The Adams predictor and corrector formulas are derived and expressed in terms of differences of the derivatives, as well as in terms of the derivatives themselves. All coefficients are given to 18 significant digits. For the difference formula only, the ratio coefficients are given to 10th order. Author

N76-26920*# Transemantics, Inc., Washington, D.C.
EXTREMAL AIMING
N. N. Krasovskiy and A. I. Subbotin Washington NASA May 1976 84 p refs Transl. into ENGLISH from the book "Pozitsionnyye differentsialnyye igry" Moscow, Nauka Press, chpt. 7, 1974 p 149-206
(Contract NASw-2792)
(NASA-TT-F-16894) Avail: NTIS HC $5.00 CSCL 12A

A description is given of basic applied problems (regulation with incomplete information, problems of pursuit and escape) which brought to life the object of applied mathematics studied in it - the differential game. Specifically described is a method of developing solutions of a position differential convergence game 9.1, which is based on auxiliary program structures. Author

N76-26921# Los Alamos Scientific Lab., N.Mex.
CAPACITANCE MATRIX TECHNIQUE
B. L. Buzbee 1975 10 p refs Presented at the Symp. on Sparse Matrix Computations, Argonne, Ill., 9 Sep. 1975
(Contract W-7405-eng-36)
(LA-UR-75-2013; Conf-750987-1) Avail: NTIS HC $4.50

The capacitance matrix technique is a modification method that is associated with elliptic difference systems and is characterized by a modification of rows. A unified development of this technique where the preprocessing phase on an n by n mesh requires O(pn squared plus p cubed) operations is presented. The capacitance method and the matrix decomposition Poisson solver are developed. ERA

N76-26922# Illinois Univ., Urbana. Dept. of Computer Science.
NUMERICAL ERRORS IN SPARSE LINEAR EQUATIONS
C. W. Gear May 1975 8 p
(Contract AT(11-1)-2383)
(COO-2383-0024) Avail: NTIS HC $4.50

Important classes of problems such as network analysis lead to very sparse unsymmetric systems of linear equations of a high order. Frequently a Gauss elimination technique is used to form the LU decomposition with some form of pivoting being done to reduce fill-in and to preserve some numerical stability. It is shown that an error bound can be obtained of the same size as that obtained when analyzing a p by p system, where p is the maximum number of non-zeros in rows or columns of the decomposed matrix. Author (ERA)

N76-26923# Michigan State Univ., East Lansing. Dept. of Mathematics.
A NUMERICAL METHOD FOR DIRECTLY SOLVING SECOND ORDER FUNCTIONAL DELAY EQUATIONS Final Report
Richard A. Rogers and G. D. Taylor 1975 16 p refs
(Grant AF-AFOSR-2271-72; AF Proj. 9749)
(AD-A020683; AFOSR-76-0062TR) Avail: NTIS CSCL 12/1

A method is given for the numerical solution of a second order difference differential equation with constant retardation, 2nd derivative(dx/dt) + f(t,x(t), x(t-r), dx/dt, dx/dt(t-r)) = 0, r = 0, t= 0, which does not require decomposition into a system of first order equations. GRA

N76-26924# Colorado State Univ., Fort Collins. Dept. of Mathematics.
AN ALTERNATION THEORY FOR COPOSITIVE APPROXIMATION Interim Report
Eli Passow and G. D. Taylor 1975 28 p refs
(Grant AF-AFOSR-2878-76; AF Proj. 9749)
(AD-A020690; AFOSR-76-0061TR) Avail: NTIS CSCL 12/1

The problems of comonotone and copositive approximation were investigated. Estimates were derived for the error of the best constrained approximation analogous to the Jackson theorems of the standard theory. It is noted that copositive approximation can be viewed as a special case of restricted range approximation, and from this, existence and uniqueness of the best copositive approximation is established. An alternation theory is developed characterizing the best approximation to f from K sub f. Author

N76-26925# Naval Postgraduate School, Monterey, Calif.
A BRANCH AND BOUND METHOD FOR NONSEPARABLE NONCONVEX OPTIMIZATION
James K. Hartman Oct. 1975 14 p refs
(RR0000110)
(AD-A021856; NPS-55HH75102) Avail: NTIS CSCL 12/1

In this paper a nonconvex programming algorithm which was developed originally for separable programming problems is formally extended to apply to nonseparable problems also. It is

shown that the basic steps of the method can be modified so that separability is no restriction. Author (GRA)

N76-26564 Waterloo Univ. (Ontario).
USE OF GALERKIN'S METHOD FOR VIBRATION PROBLEMS
In Shock and Vibration Inform. Center The Shock and Vibration Digest, Vol. 8, No. 2 Feb. 1976 p 3-18 refs (For availability see N76-26563 17-39)
CSCL 20/11

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N76-26926 Texas A&M Univ., College Station.
STATISTICAL TESTS FOR THE COMPARISON OF MARKOV RENEWAL PROCESSES Ph.D. Thesis
Gerald Ray Stewart 1975 114 p
Avail: Univ. Microfilms Order No. 76-12696

Statistical tests for comparing two or more independent Markov Renewal Processes are investigated. Tests are derived by extending statistical methods of Markov Chains to the Markov Renewal Processes. Tests are developed for (1) comparison of transition probabilities for various holding time conditions and (2) comparisons of holding time distributions for various conditions on transition probabilities. The tests are illustrated and evaluated using simulated data representing (1) vehicular traffic on highways and (2) verbal behavior of students and teachers in classrooms. Applications of the tests are discussed as well as suggested areas of future research on statistical methods for Markov Renewal Processes. Dissert. Abstr.

N76-26927 Florida Univ., Gainesville.
DISCRETE KALMAN FILTERING AND STOCHASTIC IDENTIFICATION USING A GENERALIZED COMPANION FORM Ph.D. Thesis
Zuonha Luo 1975 78 p
Avail: Univ. Microfilms Order No. 76-12088

A key idea is the use of a special form called the generalized companion form. It is a modification of Luenberger's second form. It is shown that this special form provides more insight into the problems and leads to new results. The method using the generalized companion form in the Kalman filtering problem gives a considerable reduction in the number of difference equations involved in the determination of the filter gain. For an nth order constant system with p outputs, the usual method uses $n(n+1)/2$ difference equations to determine the filter gain. The method presented requires that only $np-p(p-1)/2$ difference equations be solved. When generalized companion form is applied to the stochastic identification problem, it is shown that at most $np-p(p-1)/2$ unknowns in the system noise covariance matrix, Q, can be identified from the measurements. Dissert. Abstr.

N76-26928*# Houston Univ., Tex. Dept. of Mathematics.
THE NUMERICAL EVALUATION OF THE MAXIMUM-LIKELIHOOD ESTIMATE OF A SUBSET OF MIXTURE PROPORTIONS
B. Charles Peters, Jr. and Homer F. Walker Feb. 1976 14 p refs
(Contract NAS9-12777)
(NASA-CR-147738; Rept-50) Avail: NTIS HC $3.50 CSCL 12A

Necessary and sufficient conditions are given for a maximum likelihood estimate of a subset of mixture proportions. From these conditions, likelihood equations are derived satisfied by the maximum-likelihood estimate and a successive-approximations procedure is discussed as suggested by equations for numerically evaluating the maximum-likelihood estimate. It is shown that, with probability one for large samples, this procedure converges locally to the maximum-likelihood estimate whenever a certain step-size lies between zero and two. Furthermore, optimal rates of local convergence are obtained for a step-size which is bounded below by a number between one and two. Author

N76-26929*# Houston Univ., Tex. Dept. of Mathematics.
AN ITERATIVE PROCEDURE FOR OBTAINING MAXIMUM-LIKELIHOOD ESTIMATES OF THE PARAMETERS FOR A MIXTURE OF NORMAL DISTRIBUTIONS, 2
B. Charles Peters, Jr. and Homer F. Walker Feb. 1976 37 p refs
(Contract NAS9-12777)
(NASA-CR-147739; Rept-51) Avail: NTIS HC $4.00 CSCL 12A

The problem of obtaining numerically maximum likelihood estimates of the parameters for a mixture of normal distributions is addressed. In recent literature, a certain successive approximations procedure, based on the likelihood equations, is shown empirically to be effective in numerically approximating such maximum-likelihood estimates; however, the reliability of this procedure was not established theoretically. Here, a general iterative procedure is introduced, of the generalized steepest-ascent (deflected-gradient) type, which is just the procedure known in the literature when the step-size is taken to be 1. With probability 1 as the sample size grows large, it is shown that this procedure converges locally to the strongly consistent maximum-likelihood estimate whenever the step-size lies between 0 and 2. The step-size which yields optimal local convergence rates for large samples is determined in a sense by the separation of the component normal densities and is bounded below by a number between 1 and 2. Author

N76-26930*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A NUMERICAL COMPARISON OF DISCRETE KALMAN FILTERING ALGORITHMS: AN ORBIT DETERMINATION CASE STUDY
Catherine L. Thornton and Gerald J. Bierman 15 Jun. 1976 44 p refs
(Contract NAS7-100)
(NASA-CR-148278; JPL-TM-33-771) Avail: NTIS HC $4.00 CSCL 09B

The numerical stability and accuracy of various Kalman filter algorithms are thoroughly studied. Numerical results and conclusions are based on a realistic planetary approach orbit determination study. The case study results of this report highlight the numerical instability of the conventional and stabilized Kalman algorithms. Numerical errors associated with these algorithms can be so large as to obscure important mismodeling effects and thus give misleading estimates of filter accuracy. The positive result of this study is that the Bierman-Thornton U-D covariance factorization algorithm is computationally efficient, with CPU costs that differ negligibly from the conventional Kalman costs. In addition, accuracy of the U-D filter using single-precision arithmetic consistently matches the double-precision reference results. Numerical stability of the U-D filter is further demonstrated by its insensitivity of variations in the a priori statistics. Author

N76-26931*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MULTIVARIATE NORMALITY
Harold L. Crutcher (NOAA, Asheville, N. C.) and Lee W. Falls May 1976 286 p refs
(NASA-TN-D-8226) Avail: NTIS HC $9.25 CSCL 12A

Sets of experimentally determined or routinely observed data provide information about the past, present and, hopefully, future sets of similarly produced data. An infinite set of statistical models exists which may be used to describe the data sets. The normal distribution is one model. If it serves at all, it serves well. If a data set, or a transformation of the set, representative of a larger population can be described by the normal distribution, then valid statistical inferences can be drawn. There are several tests which may be applied to a data set to determine whether the univariate normal model adequately describes the set. The chi-square test based on Pearson's work in the late nineteenth and early twentieth centuries is often used. Like all tests, it has some weaknesses which are discussed in elementary texts. Extension of the chi-square test to the multivariate normal model is provided. Tables and graphs permit easier application of the test in the higher dimensions. Several examples, using recorded data, illustrate the procedures. Tests of maximum absolute differences, mean sum of squares of residuals, runs and changes of sign are included in these tests. Dimensions one through five

with selected sample sizes 11 to 101 are used to illustrate the statistical tests developed. Author

N76-26932*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COST ESTIMATION: AN EXPERT-OPINION APPROACH
Charles Buffalano, Stephen Fogleman, and Mark Gielecki Washington Jun. 1976 13 p refs
(NASA-TN-D-8256; G-7695) Avail: NTIS HC $3.50 CSCL 05C

A methodology is outlined which can be used to estimate the costs of research and development projects. The approach uses the Delphi technique a method developed by the Rand Corporation for systematically eliciting and evaluating group judgments in an objective manner. The use of the Delphi allows for the integration of expert opinion into the cost-estimating process in a consistent and rigorous fashion. This approach can also signal potential cost-problem areas. This result can be a useful tool in planning additional cost analysis or in estimating contingency funds. A Monte Carlo approach is also examined.
Author

N76-26933# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
DISTRIBUTION OF THE SKEWNESS AND KURTOSIS STATISTICS IN GENERAL
K. O. Bowman and L. R. Shenton 1975 29 p refs Presented at the 1st ERDA Statistical Symp., Los Alamos, N. Mex. Sponsored by ERDA
(Conf-751113-6) Avail: NTIS HC $5.00

An attempt is made to find moments of sample moments which result in Taylor-series developments in power of the inverse sample size. ERA

N76-26934# Institut Royal Meteorologique de Belgique, Brussels.
THE SAMPLING OF A CONTINUOUS FUNCTION
F. DeMeyer 1975 57 p refs
(Misc-Ser-C-12) Avail: NTIS HC $4.50

A physically motivated and systematic account is given of the problems arising when a continuous function is digitized to a finite, discrete sequence of ordinates, and the relation of the Fourier spectrum of the original function to the Fourier spectrum of the sampled time series is considered. The methodology of the periodic, aperiodic, and random functional scheme is indicated. The measurement or computation of the Fourier spectrum of a function is affected by the digitization and the truncation of the function to a finite length. The sampling theorem is used to explain the frequency structure of a band-limited function and to indicate the maximum allowed distance in time between two consecutive samples. The aliasing problem appears as an unavoidable consequence of an incorrect sampling of the continuous time function. A method is given to reduce the variability of the calculated Fourier spectrum. ESA

N76-26935# Washington Univ., St. Louis, Mo. Dept. of Systems Science and Mathematics.
AN EXACT ESTIMATOR-CONTROLLER SOLUTION TO A STOCHASTIC OPTIMAL-CONTROL PROBLEM WITH POINT PROCESS OBSERVATIONS Interim Report
Donald L. Snyder, Ian B. Rhodes, and Estil V. Hoversten Sep. 1975 7 p refs Presented at the Symp. on Nonlinear Estimation and its Appl. (6th), San Diego, Calif., Sep. 1975
(Grants AF-AFOSR-2496-73; NSF ENG-74-07800; AF Proj. 9749)
(AD-A019555; AFOSR-75-1599TR) Avail: NTIS CSCL 12/1

The so-called dual control problem is the most general stochastic optimal-control problem and has been solved only under very restrictive conditions. Of special importance is the separation theorem which demonstrates that for a linear stochastic plant, quadratic costs, and linear observations in additive Gaussian noise, the optimal control law can be determined by solving separately and independently a causal stochastic-estimation problem and a deterministic control problem. In this paper, we give the exact solution to a dual control problem involving a linear stochastic plant, quadratic costs, and nonlinear, nonGaussian observations. The observations are in the form of a point process in which each point has both a temporal and a spatial coordinate. The state of the stochastic plant influences the intensity of the observed time-space point process. We show that the solution to this dual control problem can be realized with a separated estimator-controller in which the estimator is nonlinear, mean-square optimal, and finite-dimensional, and the controller is linear. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N76-26936 Texas A&M Univ., College Station.
QUEUEING MODELS OF MULTIPROGRAMMED COMPUTER SYSTEMS WITH A MULTILEVEL MEMORY HIERARCHY Ph.D. Thesis
Don Martin Warner 1975 184 p
Avail: Univ. Microfilms Order No. 76-12705

A collection of queueing network models with distinguishable tasks in the system is developed and solved to represent various aspects of a multiprogrammed computer system. The basic model is a closed queueing network which models a system with a multilevel memory hierarchy with distinguishable tasks in the system. Equations which describe the behavior of the system are solved analytically. Using the solution of these equations, various performance measures - processor utilization, queue lengths, rate of task execution, expressions for system overhead, and effective CPU utilization - are developed. The basic model is altered to reflect the presence of jobs which access the system through terminals and are swapped in and out of memory. Again, the equations which describe the behavior of the system are solved analytically and an expression for the percentage of time that the CPU is processing a swapped job is obtained.
Dissert. Abstr.

N76-26937 Iowa Univ., Iowa City.
OPTIMAL CONTROL OF DELAY SYSTEMS Ph.D. Thesis
Zeungnam Bien 1975 167 p
Avail: Univ. Microfilms Order No. 76-13363

The problem of optimally controlling a delay-differential system to a final function was investigated, and necessary and sufficient conditions for the problem were obtained. The final function condition was replaced by (1) a control-state variable equality constraint and (2) a conventional target condition. Then a method on ordinary differential systems with similar constraints was applied. The necessary condition derived was in the form of a point-wise maximum principle, with the nontriviality condition in the adjoint variable. The result was shown to be valid for the problems with bounded controls and also for the problems in which some components of the final function were free. Finally, sufficient conditions for the problem were studied. The result showed that the necessary condition was also sufficient for a certain class of problems. Dissert. Abstr.

N76-26938 Stanford Univ., Calif.
INTERPROCESS COMMUNICATION PROTOCOLS FOR COMPUTER NETWORKS Ph.D. Thesis
Carl Allan Sunshine 1976 274 p
Avail: Univ. Microfilms Order No. 76-13080

The design and analysis of interprocess communication protocols for networks of computers are studied. Previous research has emphasized system performance at lower levels, within the communication medium itself. This work examines requirements and performance of protocols for communication between processes in the host computers attached to the communication system. Both the reliability and the efficiency of protocols are discussed. Reliability involves overcoming unreliable network transmission facilities to avoid loss, duplication, or out-of-order delivery of data. Reliability performance goals are defined, and the correctness of different protocol mechanisms in achieving these goals is demonstrated. Consequences of protocol failures (host crashes) and problems of initializing control mechanisms required for reliable communication are also considered.
Dissert. Abstr.

N76-26939*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
IDENTIFICATION OF SYSTEMS BY MEANS OF ADAPTIVE MODEL

Josef Salaba Washington NASA May 1976 25 p refs Transl. into ENGLISH from Zprav. Vyzk. Letecky Ustav (Prague), no. 6, 1974 p 5-14
(Contract NASw-2789)
(NASA-TT-F-16956) Avail: NTIS HC $3.50 CSCL 12B

Methods of identifying systems are reviewed and evaluated, and a method based on the use of adaptive models is then analyzed. This method features three variants for coupling the models: series, series-parallel, and parallel. Analysis and derivation of identification by means of the adaptive model are given for the case when the set of state variables measured in the system is known. Possibilities for application of the method of identification with an adaptive model to a jet engine and its modifications are examined. Author

N76-26940*# Kanner (Leo) Associates, Redwood City, Calif.
CONSTRUCTION OF THE PROFILES OF MULTIPLE MANIFOLDS OBTAINED IN STUDYING THE RELATIONSHIP BETWEEN PHYSICAL DIMENSIONS
L. S. Gurin and N. F. Smirnova Washington NASA Jun. 1976 21 p refs Transl. into ENGLISH of Russian report Pr-253 (Moscow), 1975 21 p
(Contract NASw-2790)
(NASA-TT-F-15466; Pr-253) Avail: NTIS HC $3.50 CSCL 09B

The problem of representing the results of physical experiments, in the form of a set of points in multidimensional space, the coordinates of which are time, the spatial coordinates of the points at which the measurements were made, as well as the parameters obtained by initial processing of the measurement results are discussed. Procedures are developed for discarding negligible parameters, separation of groups of points by 2 operations A and B, and for 2 cases of plotting profiles of the manifolds examined, as well as 2 cases of plotted level lines of the manifolds. A FORTRAN program and an example of testing of the algorithms are presented. Author

N76-26941# Commission of the European Communities, Ispra (Italy). Joint Research Centre.
SYSTEMS ANALYSIS AS A TOOL FOR OPTIMAL PROCESS STRATEGY
K. Ditterich and J. Schneider 1975 36 p refs
(EUR-5372) Avail: ERDA Depository Libraries HC $5.00

For the description and the optimal treatment of complex processes, the methods of systems analysis are used as the most promising approach in recent times. In general every process should be optimized with respect to reliability, safety, economy, and environmental pollution. The complex relations between these general optimization postulates are established in qualitative form. These general trend relations have to be quantified for every particular system studied in practice. Author (NSA)

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N76-26942 North Texas State Univ., Denton.
CHARACTERIZATIONS OF PROPERTIES OF SPACES OF FINITELY ADDITIVE SET FUNCTIONS IN TERMS OF MAPPINGS AND INTEGRALS Ph.D. Thesis
Wayne Charles Bell 1975 50 p
Avail: Univ. Microfilms Order No. 76-13172

The relationship is studied between a class of nonlinear functions defined on P sub AB and certain subspaces of P sub AB, in particular Appling's linear C-sets, Solomon Leader's finite additive L sub p spaces, and one of the projective limit spaces studied by Davis, Murray, and Weber. Some of the latter's results concerning the normability of any topology on H sub omega(mu) finer than each relative p-norm topology are generalized and extended. Dissert. Abstr.

N76-26943 Louisiana State Univ. and A&M Coll., Baton Rouge.
INFINITE-DIMENSIONAL TOPOLOGY AND THE THEORY OF SHAPE Ph.D. Thesis
Zvonko Tomislav Cerin 1975 110 p
Avail: Univ. Microfilms Order No. 76-12909

The complement theorems of Chapman were applied to the investigation of various shape invariants of compacta. This led to the study of the following three different but closely related topics: (1) a reworking of a large portion of the shape theory of compacta using techniques of infinite-dimensional topology, including discussions on shape dimension, movability, shape absolute neighborhood retracts, shape absolute retracts, (2) a study of the homotopy theory of non-compact locally compact metric spaces, (3) an exploration of the relationships between the previous two topics. Dissert. Abstr.

N76-26944 Stanford Univ., Calif.
VARIATIONAL METHODS, AND BOUNDS FOR LATTICE FIELD THEORIES Ph.D. Thesis
Robert Bernard Pearson, III 1976 113 p
Avail: Univ. Microfilms Order No. 76-13061

Formalism is developed for describing a field theory on a lattice. This reduction in complexity over the full field theory allows the development of a variety of variational tools for investigating the ground state of the field theory. Of particular interest in this respect is the study of large distance coherent phenomena such as spontaneous symmetry breaking. Numerical results are given for variational calculations of upper and lower bounds on the energy density of the ground state.Dissert. Abstr.

N76-26945# Forschungsinstitut fuer Funk und Mathematik, Werthoven (West Germany).
REPRESENTATION OF NET CATEGORIES AS SEMIGROUPS WITH OPERATOR [DARSTELLUNG VON NETZKATEGORIEN ALS HALBGRUPPEN MIT OPERATOR]
U. Klemm Apr. 1975 44 p refs In GERMAN; ENGLISH summary
(Rept-227) Avail: NTIS HC $4.00

X-categories with a set of nonnegative integers as object domain are shown to be representable as semigroups with one free operator. The theory of relation systems concerning such semigroups turns out to be a slight extension of the well-known derivation theory on free monoids. Author (ESA)

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N76-26946# Energy Research and Development Administration, Washington, D.C.
PULSABLE SUPERCONDUCTING 28 kJ SOLENOID MAGNET
K. P. Juengst and G. Obermaier 1975 17 p refs Transl. into ENGLISH from German Report,
(ERDA-tr-92) Avail: NTIS HC $3.50

The design, construction, and testing of a pulsable superconducting solenoid magnet are described. The magnet has a cold bore of 80 mm diameter, and it reached a central field of 4.75 T after little training in the first run. The field homogeneity is 0.1 percent in 30 mm dsv and 1 percent in 60 mm dsv. The peculiarities of this solenoid are the fully insulated braid conductor, consisting of 32 multifilament wires with 206 NbTi filaments each, and the application of copper heat sinks for the cooling of the magnet windings. The magnet reached a rate of field change of 2 T/s or 630 A/s without significant degradation with respect to dc operation. The magnet is to provide a homogeneous magnetic field in a large working volume to measure frequency dependent losses in superconductors.
Author (NSA)

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N76-26947 Stanford Univ., Calif.
ACOUSTIC APPLICATIONS OF THE ZONE PLATE Ph.D. Thesis
Stephen Allen Farnow 1976 152 p
Avail: Univ. Microfilms Order No. 76-12999

Applications of the classical zone plate and related apertures in the field of acoustics were described. Focal properties of these apertures were described and closed form expressions for both focal plane and axial intensity distributions were derived. The basic principles involved in Fresnel's zone plate construction were then utilized in the design of acoustic transducers capable of producing focused sound beams. Acoustic zone plate transducers were described. Experiments were performed with both fixed-electrode and optically-switched transducers. Experimental verification of the focusing capabilities of these devices was made. The theory and fabrication of similar transducers, designed to focus sound in water at frequencies near 10 MHz, are discussed. Experimental focal plane intensity distributions, as measured with a small acoustic point probe, are presented. The frequency dependence of these distributions is related to the angular acceptance response of the piezoelectric plate. Dissert. Abstr.

N76-26948*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TEST-SECTION NOISE OF THE AMES 7 BY 10-FOOT WIND TUNNEL NO. 1
Paul T. Soderman (Army Air Mobility R and D Lab., Moffett Field, Calif.) May 1976 68 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-73134; A-6601) Avail: NTIS HC $4.50 CSCL 20A

An investigation was made of the test-section noise levels at various wind speeds in the Ames 7- by 10-Foot Wind Tunnel No. 1. No model was in the test section. Results showed that aerodynamic noise from various struts used to monitor flow conditions in the test section dominated the wind-tunnel background noise over much of the frequency spectrum. A tapered microphone stand with a thin trailing edge generated less noise than did a constant-chord strut with a blunt trailing edge. Noise from small holes in the test-section walls was insignificant.
Author

N76-26949*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
CONCORDE NOISE-INDUCED BUILDING VIBRATIONS FOR SULLY PLANTATION, CHANTILLY, VIRGINIA
W. H. Mayes, H. F. Scholl, D. G. Stephens, B. G. Holliday, R. Deloach, H. K. Holmes, R. B. Lewis, and J. W. Lynch Washington Jun. 1976 43 p refs
(NASA-TM-X-73919; Rept-2630) Avail: NTIS HC $4.00 CSCL 20A

A study to assess the noise-induced building vibrations associated with Concorde operations is presented. The approach is to record the levels of induced vibrations and associated indoor/outdoor noise levels in selected homes, historic and other buildings near Dulles and Kennedy International Airports. Presented is a small, representative sample of data recorded at Sully Plantation, Chantilly, Virginia during the period of May 20 through May 28, 1976. Recorded data provide relationships between the vibration levels of walls, floors, windows, and the noise associated with Concorde operations (2 landings and 3 takeoffs), other aircraft, nonaircraft sources, and normal household activities. Results suggest that building vibrations resulting from aircraft operations were proportional to the overall sound pressure levels and relatively insensitive to spectral differences associated with the different types of aircraft. Furthermore, the maximum levels of vibratory response resulting from Concorde operations were higher than those associated with conventional aircraft. The vibrations of nonaircraft events were observed in some cases to exceed the levels resulting from aircraft operations. These nonaircraft events are currently being analyzed in greater detail. Author

N76-26950*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE MEASUREMENTS FOR A TWIN-ENGINE COMMERCIAL JET AIRCRAFT DURING 3 DEG APPROACHES AND LEVEL FLYOVERS
Earl C. Hastings, Jr., Robert E. Shanks, and Arnold W. Mueller Washington Jul. 1976 60 p refs
(NASA-TM-X-3387; L-10780) Avail: NTIS HC $4.50 CSCL 20A

Noise measurements have been made with a twin-engine commercial jet aircraft making 3 deg approaches and level flyovers. The flight-test data showed that, in the standard 3 deg approach configuration with 40 deg flaps, effective perceived noise level (EPNL) had a value of 109.5 effective perceived noise decibels (EPNdB). This result was in agreement with unpublished data obtained with the same type of aircraft during noise certification tests; the 3 deg approaches made with 30 deg flaps and slightly reduced thrust reduced the EPNL value by 1 EPNdB. Extended center-line noise determined during the 3 deg approaches with 40 deg flaps showed that the maximum reference A-weighted sound pressure level (LA,max)ref varied from 100.0 A-weighted decibels 2.01 km (108 n. mi.) from the threshold to 87.4 db(A) at 6.12 km (3.30 n. mi.) from the threshold. These test values were about 3 db(A) higher than estimates used for comparison. The test data along the extended center line during approaches with 30 deg flaps were 1 db(A) lower than those for approaches with 40 deg flaps. Flight-test data correlating (LA,max)ref with thrust at altitudes of 122 m (400 ft) and 610 m (2000 ft) were in agreement with reference data used for comparison.
Author

N76-26951# Yale Univ., New Haven, Conn. Dept. of Engineering and Applied Science.
SPATIAL INTERFREQUENCY CORRECTION EFFECTS IN A SURFACE SCATTER CHANNEL
J. F. McDonald, F. B. Tuteur, and J. G. Zornig 18 Dec. 1975 48 p refs
(Contracts N00014-75-C-0298; N00140-72-C-1298)
(AD-A020019; TR-CS-6) Avail: NTIS CSCL 20/1

The effect of spatial separation on the cross-correlation between the system response functions for a two receiver surface scatter channel is investigated. The system response at the two receivers is determined for all possible pairs of frequencies. The analysis assumes relatively close separation of receivers and uses the Fresnel corrected model for surface scatter in the specular direction. The surface is assumed to be Gaussian, with typical size of boundary deformations small compared to typical Fresnel zones. The analysis shows that the correlation is approximately maximum for zero frequency separation and drops off at a rate determined by the reverberation time. For small reverberation times and small grazing angles correlation may extend over fairly large values of frequency difference. The effect of spatial separation is generally a reduction in correlation and a more rapid decrease of correlation with frequency, but this can be compensated to some extent by time shift between the two system responses. Experimental evidence is included to support the theoretical predictions presented. GRA

N76-26952# Naval Postgraduate School, Monterey, Calif.
FINITE-AMPLITUDE STANDING WAVES IN REAL CAVITIES CONTAINING DEGENERATE MODES M.S. Thesis
Winfield Scott Slocum, IV Dec. 1975 64 p refs
(AD-A020056) Avail: NTIS CSCL 20/1

Finite-amplitude standing waves in air at ambient temperatures contained within a rigid-walled rectangular cavity having one variable interior dimension were experimentally investigated. The effect of degenerate or nearly degenerate configurations on the harmonic content of the observed pressure waveform was compared to the theory of Coppens and Sanders as modified to include empirically determined losses and resonances. Second and third harmonic distortion for both degenerate and nondegenerate cavity configurations were recorded as continuous functions of frequency in the vicinity of the resonances for the 100 and 110 modes. It was found that in rectangular cavities having walls free of any perturbation, the theoretical model can accurately predict both shapes and amplitudes of the harmonic content of the finite-amplitude standing wave whether or not degeneracies are present.
Author (GRA)

N76-26953# Naval Postgraduate School, Monterey, Calif.
SOLID-STATE DIGITAL IN-SITU ACOUSTIC DATA ACQUISITION M.S. Thesis

David Michael Craig Dec. 1975 102 p refs
(AD-A020054) Avail: NTIS CSCL 14/3

The problems of acoustic environmental data recording are studied to develop an alternative to conventional magnetic-tape digital storage for in situ recording instruments. Various physical data transducers are analyzed to determine which types are best suited for portable solid-state environmental recorders, and a discussion of information processing concentrates on the problems of high-density versus low-density digital data storage and on methods for effecting large-scale data reductions. Recent advances in integrated-circuit electronics are evaluated in terms of suitability for use in instrumentation requiring both large-scale memory capacity and low power consumption. Results of the research include functional block diagrams of an ambient sea-noise recorder and a shipping-container impact recorder.
Author (GRA)

N76-26954# Naval Postgraduate School, Monterey, Calif.
THE EFFECTS OF SIMPLE BOUNDARY IRREGULARITIES ON ACOUSTICAL MODE PROPAGATION IN DUCTS WITH PRESSURE RELEASE BOUNDARIES M.S. Thesis
Luis Fernando Pereira DaSilvaNunes Dec. 1975 48 p refs
(AD-A020105) Avail: NTIS CSCL 20/1

Effects of boundary irregularities on acoustical mode propagation in ducts, with pressure release walls are theoretically studied. Several particular wall irregularities are explored: sinusoidal, delta-function and spatially decaying wall perturbations. Strong effects (resonances) appear in the case of the sinusoidal wall. In the other two cases, the resonances are not present, but there are still traveling disturbances whose effects can be important at great distances from the wall irregularity. GRA

N76-26955# Pennsylvania State Univ., University Park. Applied Research Lab.
NOISE DUE TO INTERACTION iNLET TURBULENCE AND GUIDE VANE SECONDARY FLOW WITH PROPULSOR
B. Lakshminarayana, N. Moiseev, and D. E. Thompson 2 Oct. 1975 20 p refs
(Contract N00017-73-C-1418)
(AD-A020096; TM-75-237) Avail: NTIS CSCL 20/1

The objective of this investigation is to study the radiated sound from a propulsor rotating blade row due to operation in various types of turbulent inflows; control surface wakes, hub and annulus wall boundary layers, and secondary flow. Each type of inflow exists in a typical underwater vehicle with struts or control surfaces upstream of the propulsor. The experimental program consists of detailed flow measurements upstream of the blade row (mean velocities, turbulence intensities, shear stresses, and spectra), as well as near and far-field acoustic measurements with the various types of inflows. The parameters being varied for each type of inflow are: (a) flow coefficient, (b) inlet boundary layer thickness, (c) strut configuration. The test medium is air. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N76-26956 Stanford Univ., Calif.
MEASUREMENT OF THE GROUND STATE LAMB SHIFT OF ATOMIC HYDROGEN AND DEUTERIUM BY LASER SPECTROSCOPY Ph.D. Thesis
Siu Au Lee 1976 127 p
Avail: Univ. Microfilms Order No. 76-13032

The 1S-2S transition in atomic hydrogen and deuterium was studied using Doppler-free two-photon spectroscopy. By comparing the 1S-2S transition to the visible Balmer-beta saturation spectrum, the ground state Lamb shifts of hydrogen and deuterium are measured. Their values are, respectively, 8.20 + or - 0.10 GHz for hydrogen, and 8.25 + or - 0.11 GHz for deuterium, in agreement with the theoretical values. The isotope shift of the 1S-2S transition was also investigated, and is found to be 670.932 + or - 0. 056 GHz. In this investigation, ground state hydrogen atoms are excited to the metastable 2S state by the absorption of two photons of wavelength 2431A, provided by a frequency doubled, narrowband pulsed dye laser. The excitation is monitored by observing the collision induced 2P-1S Lyman-alpha fluorescence at the wavelength of 1216A. The fundamental dye laser wavelength, at 4863A, coincides with the hydrogen Balmer-beta transition, and is used to obtain the saturation spectrum of this line. Dissert. Abstr.

N76-26957 Colorado State Univ., Fort Collins.
MONTE CARLO STUDIES OF SMALL CLUSTERS OF ATOMS Ph.D. Thesis
Jaya B. Kaelberer 1975 79 p
Avail: Univ. Microfilms Order No. 76-13644

The thermodynamic properties of small clusters of rare gas atoms were studied at different temperatures using a biased random walk Monte Carlo procedure. The existence of solid-liquid and liquid-gas transitions was established. It was found that when the cluster was placed in a box, its physical properties were independent of the volume of the box, provided the volume was large enough. The stable structures of the various clusters were also determined. Thus, 3 particles form an equilateral triangle, 5 a trigonal bipyramid and 7 a pentagonal bi-pyramid. The 9 particle structure is a pentagonal bi-pyramid with 2 atoms added adjacently, and 13 particles forms an icosahedron. Dissert. Abstr.

N76-26958 Columbia Univ., New York.
LOW ENERGY ELECTRON SCATTERING BY POLAR MOLECULES Ph.D. Thesis
William George Becker 1975 112 p
Avail: Univ. Microfilms Order No. 76-13122

Rotational excitation cross sections for the scattering of cesium fluoride by low energy electrons (1 to 5 ev.) are measured using the method of double quadrupole state selection. Observation of collision events is made on the scattered molecular beam rather than the electrons, leading to absolute total excitation cross sections. A velocity selected beam of CsF is state selected by the first quadrupole tuned to the J=1 M=0 rotational state. The focused beam enters the scattering region of an electron gun where it is crossed at 90 degrees by a 100 percent modulated electron beam. The scattered beam enters the second quadrupole tuned to J=2 M=0, which focuses the scattered signal onto a hot wire surface ionization detector. The results of the apparatus excitation cross sections show satisfactory agreement with the predicted apparatus cross sections in the First Born Approximation. Dissert. Abstr.

N76-26959 Temple Univ., Philadelphia, Pa.
TOPICS IN RANDOM ELECTRON AND SPIN SYSTEMS Ph.D. Thesis
Dov J. Shazeer 1976 301 p
Avail: Univ. Microfilms Order No. 76-12032

A T-matrix range truncation scheme is applied to a one-dimensional and three-dimensional, Wannier-model binary alloy with nearest-neighbor hopping. The density of states are calculated for a variety of systems. Numerical results are obtained for the effective-medium self-energies and the range of the Green functions. A hierarchy of T-matrix range truncation schemes are applied to a model magnetic-bond random dilute Heisenberg ferromagnet, with isotropic nearest-neighbor exchange, in the spin-wave limit. The results of three different truncation schemes are obtained. The density of states results are shown to improve as the truncation range increases. The physical properties of finite magnetic systems with simulated amorphousness are studied. Numerical results for the partition function, the energy, the density of states, the specific heat, the magnetization, the susceptibility, and some correlation functions vs. the temperature are obtained. Dissert. Abstr.

N76-26960 Stanford Univ., Calif.
A STUDY OF THE ORBITAL CORRECTION METHOD Ph.D. Thesis
Richard Andrew Meserve 1976 201 p
Avail: Univ. Microfilms Order No. 76-13045

Two approximations of interest in atomic, molecular, and solid state physics are explored. First, a procedure for calculating an approximate Green's function for use in perturbation theory is derived. In lowest order it is shown to be equivalent to treating the contribution of the bound states of the unperturbed

Hamiltonian exactly and representing the continuum contribution by plane waves orthogonalized to the bound states. Second, the Kohn-Sham many electron formalism is discussed and formulae are derived and discussed for implementing perturbation theory within the formalism so as to find corrections to the total energy of a system through second order in the perturbation. Both approximations were used in the calculation of the polarizability of helium, neon, and argon. Dissert. Abstr.

N76-26961 Stanford Univ., Calif.
INVESTIGATIONS OF THE DEPOLARIZED RAYLEIGH SCATTERING OF CHAIN MOLECULES Ph.D. Thesis
Charles Wayland Carlson 1976 144 p
Avail: Univ. Microfilms Order No. 76-12984

A procedure has been developed to estimate the contribution of collision-induced optical anisotropy to the depolarized Rayleigh scattering (DRS) of liquids and solutions. The depolarized Rayleigh ratio R for light scattering at 90 deg is measured using a He-Ne laser with a wavelength of 632.8 nm as the light source and the collisional intensity is estimated from the decrease in R when measured through narrow bandpass interference filters of 1.2 and 3.5 nm width. The technique has been tested for five optically isotropic liquids, where collisional scattering was found to dominate. The collisional portion of the DRS of chloroform, t-butyl chloride, methyl chloroform, and i-propyl chloride was also measured and compared to values obtained from direct analysis of their DRS spectra. Depolarized Rayleigh ratios have been determined for carbon tetrachloride solutions of 7 polyisobutylene samples with chain lengths from 2 to 464 bonds.
Dissert. Abstr.

N76-26962 Pennsylvania Univ., Philadelphia.
THEORETICAL STUDIES IN SURFACE PHENOMENA Ph.D. Thesis
William James Welsh 1975 240 p
Avail: Univ. Microfilms Order No. 76-12362

A more rigorous treatment for the KB theory provides expressions for gamma which are valid in principle at all temperatures of the two-phase fluid system. The continuous variation of the fluid density across the transition zone is described by a density gradient function, and the Lennard-Jones (12-6) pair potential is inserted with parameters chosen to imitate argon. The surface tension is calculated for several reasonable density gradient functions as a function of the interfacial thickness and compared with the experimental values for argon for a range of temperatures between the normal boiling point (87.28 K) and the critical point (150.87 K). A theoretical exploration of the physical adsorption of a heterogeneous diatomic molecule on a solid crystalline surface was conducted. Dissert. Abstr.

N76-26963 Pennsylvania Univ., Philadelphia.
RELATIVISTIC SCATTERED-WAVE METHOD AND ITS APPLICATIONS TO MOLECULES AND CLUSTERS IN SOLIDS Ph.D. Thesis
Cary Yuan-Wai Yang 1975 143 p
Avail: Univ. Microfilms Order No. 76-12366

A scattered-wave formalism based on the one-electron Dirac equation for a muffin-tin potential is developed. It is shown that the resulting relativistic secular equations reduce to their nonrelativistic counterparts in the infinite rest energy limit. A symmetrized version of the theory is also derived. The computer programs for the nonself-consistent field, relativistic calculations are developed and the method is tested on the molecules C2, I2, H2Te, PbS, PbSe, Pb2S2, and Pb2Se2, and different clusters in the lead chalcogenides as well as their counterparts containing certain defects. The results agree well with existing experimental data. Dissert. Abstr.

N76-26964 Louisiana State Univ. and A&M Coll., Baton Rouge.
ELECTRON IMPACT EXCITATION CROSS SECTIONS IN N V AND Ne VIII Ph.D. Thesis
Willem Lodewyk VanWyngaarden 1975 223 p
Avail: Univ. Microfilms Order No. 76-12945

Inelastic excitation cross sections were calculated for the lithium-like ions N(4+) and NE(7+) at various degrees of approximation. For N(4+), the 1s2 2s-1s2 2p cross section was calculated in a 2 state close coupling expansion with exchange at 1, 2, and 4 Rydbergs. Further calculations were made for the 1s2 2s-1s2 2p, 1s2 2s-1s2 3s, 1s2 2s-1s2 3p, 1s2 2s-1s2 3d and 1s2 2p-1s2 3s, 1s2 2p-1s2 3p, 1s2 2p-1s2 3d cross sections at 6, 8, and 16 Rydbergs in a 5 state close coupling approximation with exchange and the unitarized Coulomb-Born approximation. For Ne(7+), the cross sections were calculated in the 5 state close coupling with exchange and the unitarized Coulomb-Born approximation at 14, 18, and 30 Rydbergs. The 1s2 2s-1s2 2p cross section was further calculated in a 2 state close coupling approximation with exchange at 1.6, 3.2, and 8 Rydbergs. In all but one instance the experimental and theoretical values agree within the limits of the experiment. Dissert. Abstr.

N76-26965 Wisconsin Univ., Madison.
LASER PROBING OF EXCITED CO PRODUCTS FROM SHOCK WAVE INITIATED OXIDATION OF CARBON DISULFIDE Ph.D. Thesis
Robert Woodrow Dibble 1975 122 p
Avail: Univ. Microfilms Order No. 76-6079

The transient population of vibrationally excited carbon monoxide formed during the oxidation of carbon disulfide in a shock tube was monitored by a small signal gain experiment with a tuned cw carbon monoxide probe laser. The excited carbon monoxide was produced by the intermediate reaction cs + 0 yields co + s. A frequency stabilized, 1.8 meter electric discharge laser, cooled in a dry ice-methanol bath, was tunable over the vibrational transitions V = 15 - 14 to V = 7-6 with rotational levels J = 15 ± 2. Typical conditions behind the reflected shock in a mixture of 5% carbon disulfide - 95% oxygen were P = 500 Torr and T = 860 K. In a typical experiment, the following features were noted. After an induction time of approximately 600 microsec, amplification of the laser beam was observed for about 70 microsec. Beam attenuation immediately followed amplification for about 130 microsec.
Dissert. Abstr.

N76-26966*# Scientific Translation Service, Santa Barbara, Calif.
NEW ADAPTIVE METHODS AND THEIR EFFECTIVENESS IN REDUCING REDUNDANCY WHEN MEASURING THE STRENGTH OF THE FLUX OF PARTICLES
V. P. Yevdokimov and V. M. Pokras Washington NASA Jun. 1976 18 p refs Transl. into ENGLISH of "Novyye Adaptivnyye Metody Sokrashcheniya Izbytochnosti Izmerenii Intensivnosti Potokov Chastits i ikh Effektivnost", Rept. Pr-242 Inst. of Space Res., Acad. of Sci. USSR, 1975 p 1-13
(Contract NASw-2791)
(NASA-TT-F-15467; Pr-242) Avail: NTIS HC $3.50 CSCL 20H

Algorithms are proposed for reducing redundancy in measurements of particle flux, using as a criterion of accuracy a limitation on the maximum relative error of the readings. Author

N76-26967*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD OF PRODUCING I-123 Patent Application
James W. Blue, inventor (to NASA) Filed 3 Oct. 1975 10 p
(NASA-Case-LEW-11390-4; US-Patent-Appl-SN-619471) Avail: NTIS HC $3.50 CSCL 06R

A patent application for an invention related to the generation of high purity radioiodine (I123) was presented. The resulting product may be used for thyroid measurements and as a general radionuclide. The approach consists in bombarding a cesium heat pipe with high energy protons, causing a spallation reaction which produces vapors of Xe123 and contaminants. The contaminants are removed in a dry ice cold trap while the Xe123 condenses in a liquid nitrogen trap where it decays to I123. NASA

N76-26968# Pittsburgh Univ., Pa. Atomic Sciences Inst.
ATOMIC AND MOLECULAR PROCESSES Technical Progress Summary Report
M. A. Biondia, F. Kaufman, E. C. Zipf, J. N. Bardsley, and W. L. Fite 30 Oct. 1975 16 p refs
(Contract N00014-67-C-0098; ARPA Order 2686)
(AD-A019137; TSR-19) Avail: NTIS CSCL 20/5

Contents: Laser Studies; Atmospheric Radiation Backgrounds; and Infrared Chemiluminescence and Early Warning.
GRA

N76-26969# Aerospace Corp., El Segundo, Calif. Materials Sciences Lab.
FORWARD AND BACKWARD PHOTOEMISSION YIELDS FROM METALS AT VARIOUS X-RAY ANGLES OF INCIDENCE Interim Report
Melvin J. Bernstein and Kenneth W. Paschen 16 Dec. 1975 26 p
(Contract F04701-75-C-0076; TR-0076(6250-30)-1)
(AD-A019135; TR-0076(6250-30)-1) Avail: NTIS CSCL 20/8

X-ray generated photoemission from thin metal foils backed by graphite was measured with radiation incident from the front and back sides at several angles. Irradiation was provided by a 100-kV x-ray tube with three different filters to harden the spectrum. The total 2 pi photoelectron emission current from a surface was measured. A biased grid retarded the low-energy secondary electrons that added only 10 to 30% to the current at zero grid bias. Investigated metals were: Mg, Al, Ti, Fe, Cu, Ag, Ta, Au, and Pb. The total emission from the graphite support only was measured. It was determined that the front-to-back ratio of emission currents at normal incidence ranged from about 1.9 for Al and Mg down to about 1.1 for Ta. The photoelectron yield was found to be G sub e micron(a) S sub e electrons/photon, where micron(a) and S sub e are the energy-dependent photon absorption cross section and computed electron mean path length in the emitter and G sub E is a constant that is assumed to be independent of photon energy in the range studied but which depends on the radiation angle of incidence. For the photon energy range of 20 to 70 keV, the measured emission current densities corresponded to the following average values for G sub E: 0.37 + or - 0.06 for C, 0.30 + or - 0.03 for Al, 0.21 + or - 0.02 for Cu and Ag, and 0.18 + or - 0.02 for Ta.
Author (GRA)

N76-26970# Naval Research Lab., Washington, D.C.
ELECTRON IMPACT EXCITATION RATE COEFFICIENTS FOR IONS OF SOLAR INTEREST Memorandum Report
P. C. Kepple, J. Davis, and M. Blaha Nov. 1975 24 p refs
(AD-A019653; NRL-MR-3171) Avail: NTIS CSCL 07/4

The purpose of this interim memorandum is to provide a working document that contains the results of distorted wave calculations of the electron impact excitation rate coefficients for ions of solar interest. The list of transitions considered here is by no means exhaustive and will be appended to as additional rates become available.
GRA

N76-26971# Washington Univ., Seattle. Dept. of Chemistry.
VIBRATIONAL ENERGY TRANSFER IN UNIMOLECULAR REACTION SYSTEM
B. S. Rabinovitch, D. G. Keil, J. F. Burkhalter, and G. B. Skinner 7 Jan. 1976 12 p refs Presented at Proc. of the Intern. Shock Tube Conf. (10th), Kyoto, Japan, Jul. 1975
(Contract N00014-75-C-0690; NR Proj. 092-549)
(AD-A020302; NR092-549-TR01) Avail: NTIS CSCL 20/8

Quantitative vibrational energy transfer data for polyatomic molecules at high levels of excitation are available from experiment at temperatures below approximate 600 K. In the treatment of systems at higher temperatures, as in shock tubes, collision efficiencies are simply transferred from low to high temperature. The theory of Tardy and Rabinovitch and Lin and Rabinovitch predicts a marked decrease in efficiency with rise of temperature. Some existing unimolecular reaction shock data is examined and some difficulties in interpretation are shown to be alleviated if decreased magnitudes for vibrational energy transfer efficiencies are employed.
Author (GRA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N76-26972 Pennsylvania Univ., Philadelphia.
A THEORY OF COLLECTIVE STATES OF EVEN-EVEN SPHERICAL NUCLEI Ph.D. Thesis
Pranab Kumar Chattopadhyay 1975 157 p
Avail: Univ. Microfilms Order No. 76-12255

The application of algebraic methods to nuclear structure calculations is presented. More specifically a new theory of anharmonic vibrations is developed in the framework of these methods. In the application of the theory in the investigation of nuclear structure problems, a set of dynamical and kinematical constraints on the single particle coefficients of fractional parentage is derived. Every physical quantity of interest can be expressed in terms of the cfp's and can be evaluated from a solution of the above set of non-linear equations. The even system is much simpler and an attempt to develop an algebraic theory in parallel lines but involving even systems only is the central problem. This is accomplished by deriving, as before, a set of dynamical and kinematical constraints on the matrix elements of pair operators (bilinear combinations of fermion creation and destruction operators) between the eigenstates of the system.
Dissert. Abstr.

N76-26973 City Univ. of New York.
THE ENERGY ANALYSIS OF ELECTRON BEAMS Ph.D. Thesis
Martin Elliot Gellender 1976 125 p
Avail: Univ. Microfilms Order No. 76-13538

The rapid development of electron spectroscopy and related fields has introduced a new technology dealing with the generation, energy analysis and detection of electrons and other charged particles. A general theory is presented dealing with the fundamental principles of operation, and the limitations of performance involved in any attempt to energy analyze an electron (or charged particle) beam. The theory constitutes a distinctly new approach, capable of deriving general equations and conclusions applicable to all energy analyzers. In addition, some practical aspects of the production, focussing and energy analysis of electrons are discussed.
Dissert. Abstr.

N76-26974 Stanford Univ., Calif.
EXCHANGE CURRENTS IN ELECTRON SCATTERING FROM LIGHT NUCLEI, 1. HEAVY-ION SCATTERING AT INTERMEDIATE AND HIGH ENERGY, 2 Ph.D. Thesis
John Fraser Dubach 1976 169 p
Avail: Univ. Microfilms Order No. 76-12995

The role of meson-exchange currents in electron scattering from light nuclei was first examined in order to develop a formalism allowing us to locate situations in which the exchange-current effects are important or dominant and thus allow one to study the contributions of the meson exchanges to the electromagnetic densities within the nucleus. To facilitate the search, the model of the exchange currents is limited to the longer range one-pion exchanges. It was concluded that a careful examination of electron scattering at 500 - 1000 MeV/c momentum transfer from a series of nuclei such as those specifically examined in this work could prove fruitful in examining meson-exchange currents within the nucleus. The elastic scattering of two heavy ions at intermediate and high energies (compared to the Coulomb barrier) was then examined in the formalism of the WKB and 'Glauber theory' approximations. Finally, the model problem of scattering from a black-sphere model of the nucleus is briefly examined.
Dissert. Abstr.

N76-26975# Technical Research Centre of Finland, Helsinki.
ESTIMATION OF THE CORE-WIDE FUEL ROD DAMAGE DURING A LWR LOCA
L. Mattila, R. Sairanen and J. O. Stengard 1975 23 p refs
(Publ-12) Avail: NTIS HC $3.50

The number of fuel rods puncturing during a light water reactor loss-of-coolant accident must be estimated as a part of the plant radioactivity release analysis. Due to the great number of fuel rods in the core and the great number of contributing parameters, many of them associated with wide uncertainty and/or truly random variability limits, probabilistic methods are well applicable. A succession of computer models developed for this purpose is described. Deterministic models are shown to be seriously inadequate and even misleading under certain circumstances. A simple analytical probabilistic model appears to be suitable for many applications. Monte Carlo techniques allow the development of such sophisticated models that errors in the input data presently available probably become dominant in the

residual uncertainty of the corewide fuel rod puncture analysis.
Author

N76-26976# Brookhaven National Lab., Upton, N.Y.
HIGH-ENERGY NEUTRON IRRADIATION OF SUPERCONDUCTING COMPOUNDS
A. R. Sweedler, C. L. Snead, L. Newkirk, F. Valencia, T. H. Geballe, R. H. Schwall, and B. T. Matthias 1975 17 p refs Presented at the Intern. Conf. on Radiation Effects and Tritium Technol. for Fusion Reactors, Gatlinburg, Tenn., 1 Oct. 1975 Sponsored by ERDA
(BNL-20581; Conf-751026-33) Avail: NTIS HC $4.50

The effect of high energy neutron irradiation (E greater than 1 MeV) at ambient reactor temperatures on the superconducting properties of a variety of superconducting compounds is reported. The materials studied include the A-15 compounds Nb3Sn, Nb3Al, Nb3Ga, Nb3Ge and V3Si, the C-15 Laves phase HfV2, the ternary molybdenum sulfide Mo3Pb0-5S4 and the layered dichalcogenide NbSe2. The superconducting transition temperature has been measured for all of the above materials for neutron fluences up to 5 x 10 to the 19th power n/sq cm. The critical current for multifilamentary Nb3Sn has also been determined for fields up to 16 T and fluences between 3 x 10 to the 19th power n/sq cm and 1.1 x 10 to the 19th power n/sq cm. Author (ERA)

N76-26977# Joint Inst. for Nuclear Research, Dubna (USSR).
CRYOGENIC SOURCE OF POLARIZED ATOMS OF HYDROGEN AND DEUTERIUM
A. A. Belushkina, V. P. Vadeev, A. I. Valevich, G. I. Gai, E. D. Donets, V. P. Ershov, L. S. Kotova, Yu. A. Plis, Yu. K. Pilipenko, and V. V. Smelyanskii 1975 16 p refs In RUSSIAN
(JINR-P13-9146) Avail: ERDA Depository Libraries HC $4.50

An apparatus producing electron spin polarized atomic beams of deuterium and hydrogen is described. A cryopumping system, a superconducting sextupole magnet and liquid nitrogen cooled dissociator with a r.f. discharge are used. A possibility of developing cryogenic polarized sources is shown. Some advantages of such sources are discussed. Author (ERA)

N76-26978# Nebraska Univ., Lincoln. Dept. of Chemistry.
HALOGEN ATOM REACTIONS ACTIVATED BY NUCLEAR TRANSFORMATIONS Progress Report, 15 Feb. 1975 - 14 Feb. 1976
E. P. Rack Feb. 1976 46 p refs
(Contract E(11-1)-1617)
(COO-1617-45) Avail: NTIS HC $4.00

High energy reactions of halogen atoms or ions, activated by nuclear transformations, are being studied in gaseous, high pressure, and condensed phase saturated and unsaturated hydrocarbons, halomethanes, and other organic systems. Experimental and theoretical data are presented in the following areas: systematics of iodine hot atom reactions in halomethanes, reactions and systematics of iodine reactions with pentene and butene isomers, radiative neutron capture activated reactions of iodine with acetylene, gas to liquid to solid transition in hot atom chemistry, kinetic theory applications of hot atom reactions and the mathematical development of caging reactions, solvent dependence of the stereochemistry of the Cl-38 for Cl substitution following Cl-37 (n,gamma) Cl-38 in liquid meso and dl-(CHFCl)2. A technique was also developed for the radioassay of Al in urine specimens. NSA

N76-26979# Air Force Weapons Lab., Kirtland AFB, N.Mex.
APPLICATION OF SPACE-ANGLE SYNTHESIS TO TWO-DIMENSIONAL NEUTRAL-PARTICLE TRANSPORT PROBLEMS OF WEAPON PHYSICS Final Report
Richard M. Roberds Jan. 1976 185 p refs
(AF Proj. 9994)
(AD-A020475; AFWL-TR-75-299) Avail: NTIS CSCL 20/8

A space-angle synthesis (SAS) method has been developed for treating the steady-state, two dimensional transport of neutrons and secondary gamma rays from a point source of simulated nuclear weapon radiation in air. The method was validated by applying it to the problem of neutron transport from a point source in air over a ground interface, and then comparing the results to those obtained by DOT, a state-of-the-art, discrete-ordinates code. In the SAS method, the energy dependence of the Boltzmann transport equation was treated in the standard multigroup manner. The angular dependence was treated by expanding the flux in specially tailored trial functions and applying the method of weighted residuals which analytically integrated the transport equation over all angles. The trial functions used in the expansion were composed of odd and even combinations of selected trial solutions, the trial solutions being shaped ellipsoids which approximated the angular distribution of the neutron flux in one-dimensional space. The parameters which described the shape of the ellipsoid varied with energy group and the spatial medium, only, and were obtained from a one-dimensional, discrete-ordinates calculation. Thus, approximate transport solutions were made available for all two-dimensional problems of a certain class by using tabulated parameters obtained from a single, one-dimensional calculation. Author (GRA)

74 OPTICS

Includes light phenomena.

N76-26980 Stanford Univ., Calif.
MODE CONVERSION IN ANISOTROPIC DIELECTRIC OPTICAL WAVEGUIDES Ph.D. Thesis
Andres Albanese 1976 172 p
Avail: Univ. Microfilms Order No. 76-12969

Theory and applications for waveguides fabricated with anisotropic materials like LiNbO3 are discussed. Three types of dielectric perturbations are analyzed to produce mode conversion: first, the electro-optic effect present in LiNbO3 is used to couple two guided modes of different polarization and to fabricate an electro-optical amplitude modulator; second, grooved surfaces coupling TE and TM modes are used to fabricate an output coupler for waveguides with birefringent substrates like LiNbO3 and third, the acousto-optic effect present in LiNbO3 is used to couple guided and radiation modes. In this last case surface acoustic wave that travels collinearly to an optical guided wave converts the guided wave into a wave that leaves the guide at an angle into the substrate. Dissert. Abstr.

N76-26981 Wyoming Univ., Laramie.
RESONANT LIGHT SCATTERING FROM SPHERICAL AND NON-SPHERICAL AEROSOLS, THEORY AND EXPERIMENT Ph.D. Thesis
Daniel Edward Carroll 1975 239 p
Avail: Univ. Microfilms Order No. 76-13516

The angular light scattering patterns of particles having a characteristic dimension of the same order as the wavelength of the incident radiation, i.e., with sizes in the resonance region, were investigated in both a theoretical and an experimental fashion. The formal exact solutions of the vector wave equation were presented and applied to the cases of spherical targets, both with and without a uniform coating layer. Also, an approximate solution for the case of an axisymmetric nonsphere was obtained. Computer codes to calculate scattering patterns for these three models were developed. Experimental values of the scattering matrix elements M sub 1 and M sub 2 were obtained in the angular region 10 deg to 170 deg, for scattering from individual, slightly nonspherical aerosol particles, composed of sodium chloride or potassium sulfate, and the measured values compared to theoretical predictions using the three models. Dissert. Abstr.

N76-26982 Pennsylvania Univ., Philadelphia.
THEORETICAL AND EXPERIMENTAL ASPECTS OF RESONANT LIGHT SCATTERING Ph.D. Thesis
Joel Mitchel Friedman 1975 187 p
Avail: Univ. Microfilms Order No. 76-12276

The clear resonance Roman scattering (RR) limit is focused upon with specific emphasis on the spectroscopic potential of the phenomena. The dispersion of the scattering tensor and depolarization ratio is examined for specific symmetry groups. Many of the principles including interference effects are illustrated through the experimental results obtained from ferrocytochrome-c and azulene. The influence upon resonant scattering of relaxation inducing environmental perturbations is explored. The discussion relates such concepts as vibrational relaxation to the observed

laser induced scattering from azulene in naphthalene single crystals and ferrocytochrome-c. At liquid helium temperatures the recorded spectra show both RR and relaxed emission as expected from the timescales of the involved processes. The influence on resonant scattering of various kinds of line broadening mechanisms is also discussed. Dissert. Abstr.

N76-26983*# Santa Barbara Research Center, Goleta, Calif.
DEVELOPMENT OF InSb CHARGE-COUPLED INFRARED IMAGING DEVICES: LINEAR IMAGER Final Report
James D. Phillips 1 Apr. 1976 60 p refs
(Contract NAS1-13937)
(NASA-CR-145003) Avail: NTIS HC $4.50 CSCL 20F

The following results were accomplished in the development of charge coupled infrared imaging devices: (1) a four-phase overlapping gate with 9 transfers (2-bits) and 1.0-mil gate lengths was successfully operated, (2) the measured transfer efficiency of 0.975 for this device is in excellent agreement with predictions for the reduced gate length device, (3) mask revisions of the channel stop metal on the 8582 mask have been carried out with the result being a large increase in the dc yield of the tested devices, (4) partial optical sensitivity to chopped blackbody radiation was observed for an 8582 9-bit imager, (5) analytical consideration of the modulation transfer function degradation caused by transfer inefficiency in the CCD registers was presented, and (6) for larger array lengths or for the insertion of isolated bits between sensors, improvements in InSb fabrication technology with corresponding decrease in the interface state density are required. Author

N76-26984*# Old Dominion Univ. Research Foundation, Norfolk, Va. School of Engineering.
INFRARED BAND ABSORPTANCE CORRELATIONS AND APPLICATIONS TO NONGRAY RADIATION Progress Report, Mar. - Jun. 1976
S. N. Tiwari and S. V. S. Manian Jun. 1976 55 p refs
(Grant NsG-1282)
(NASA-CR-148210; TR-76-T13) Avail: NTIS HC $4.50 CSCL 20F

Various mathematical models for infrared radiation absorption spectra for atmospheric gases are reviewed, and continuous correlations for the total absorptance of a wide band are presented. Different band absorptance correlations were employed in two physically realistic problems (radiative transfer in gases with internal heat source, and heat transfer in laminar flow of absorbing-emitting gases between parallel plates) to study their influence on final radiative transfer results. This information will be applied to the study of atmospheric pollutants by infrared radiation measurement. Author

N76-26985*# Texas Instruments, Inc., Dallas. Central Research Labs.
DEVELOPMENT OF CCD IMAGING SENSORS FOR SPACE APPLICATIONS, PHASE 1 Final Report
Gault A. Antcliffe 15 Dec. 1975 290 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953788)
(NASA-CR-148193; TI-08-75-41) Avail: NTIS HC $9.25 CSCL 20F

The results of an experimental investigation to develop a large area charge coupled device (CCD) imager for space photography applications are described. Details of the design and processing required to achieve 400 X 400 imagers are presented together with a discussion of the optical characterization techniques developed for this program. A discussion of several aspects of large CCD performance is given with detailed test reports. The areas covered include dark current, uniformity of optical response, square wave amplitude response, spectral responsivity and dynamic range. Author

N76-26986# Lockheed Missiles and Space Co., Palo Alto, Calif.
OPTICAL WAVEGUIDES OBTAINED BY EXPOSING FUSED QUARTZ TO IONS
V. V. Vasilev, A. A. Nesterov, S. A. Sokolov, and V. V. Shashkin [1976] 4 p refs Transl. into ENGLISH from Kvantov. Elektron. (USSR), v. 3, no. 2, 1976 p 461-463
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Waveguides obtained by exposing polished fused plates to H2(+) (0.3, 0.5, 0.8 Mev), He(+) (0.25, 0.5, 1 Mev), Ar (1.5 Mev), and Xe(+) (1.5, 3 Mev) ions were discussed. The waveguide cross-section measured 5 x 10 mm, and its effective thickness varied between 0.5 and 5 microns. The maximum change in the average index of refraction was 0.065. The waveguide properties were primarily investigated at a wavelength of 632.8 nanometers from a LG-38 He-Ne laser. The index of refraction for the waveguide was given to be 1.525 + or 0.0008, and the thickness as 0.3 + or - 0.08 micron. A table of values was given for the losses sustained in the waveguide for the TE mode obtained by exposure to He(+), Ar(+), and Xe(+) (3 Mev) ions. A tendency to a diminution in losses during the transition to heavier particles was seen. This confirms the viewpoint that large disturbances are mainly responsible for the change in the refractive index. Y.J.A.

N76-26987# Telecom Australia Research Labs., Melbourne.
MEASUREMENT OF THE OUTER DIMENSIONS OF OPTICAL FIBRES
W. J. Williamson Sep. 1974 8 p refs
(Rept-6915) Avail: NTIS HC $3.50

A mechanical technique for measuring the outer diameter of optical fibers is described. Silica tubes being used for the cladding of liquid core optical fibers have variations of up to 4 micrometers in their outer diameter. Author

N76-26988*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD AND MEANS FOR TESTING A GLANCING-INCIDENCE MIRROR SYSTEM Patent Application
Carroll C. Dailey, inventor (to NASA) Filed 10 Nov. 1975 13 p
(NASA-Case-MFS-22409-2; US-Patent-Appl-SN-636193) Avail: NTIS HC $3.50 CSCL 20F

An apparatus for testing a glancing-incidence mirror system for an X-ray telescope is described. The system has an even number of coaxial and confocal reflecting surfaces, and includes an X-ray laser for generating a collimated beam of X-rays directed along the axis of the system so that the beam is incident on the reflecting surfaces and illuminates a predetermined area. An X-ray detector, such as a photographic film, is located at the common focus of the surfaces so that the image produced by the X-rays will provide a measure of the resolution and efficiency of the system. NASA

N76-26989# Addis Translations International, Portola Valley, Calif.
MIRROR SYSTEMS WITH GRAZING INCIDENCE AS IMAGE-FORMING OPTICS FOR X-RAYS
H. Wolter [1975] 39 p refs Transl. into ENGLISH from Ann. Phys. (Leipzig), ser. 6, v. 10, 1952 p 94-114 Sponsored by ERDA Prepared for Calif. Univ., Livermore. Lawrence Livermore Lab.
(UCRL-Trans-10971) Avail: NTIS HC $5.00

Systems of totally reflecting mirrors may be used as the optics in X-ray microscopy. With elimination of the spherical aberration for an axial point, these systems at the same time satisfy the Abbe sine condition up to apertures of 0.05. To investigate live biological specimens, wavelengths of approximately 24 A are recommended since these are minimally absorbed in water but have a high absorption in materials containing carbon or nitrogen. With the optical system presented, for such soft X-rays the increase in resolving power compared to ordinary light microscopes is at least one order of magnitude.
Author (ERA)

N76-26990# Sandia Labs., Albuquerque, N.Mex.
DETERMINATION OF ELECTROMAGNETIC ABSORPTION PARAMETERS BY REFLECTION MEASUREMENTS
C. N. Vittitoe Sep. 1975 44 p refs
(Contract AT(29-1)-789)
(SAND-75-0338) Avail: NTIS HC $4.00

The method described is for determining the electromagnetic absorption parameters of a material by measuring the optical reflection from a thick sample. With linearly polarized incident light (both perpendicular to and parallel to the plane of incidence), the ratio of the reflected intensities at three or more angles of

incidence offers promise for determining the complex index of refraction of a material for a broad range of parameter values. The method may be applicable to molten materials, such as UO2, where high temperatures cause corrosion and containment difficulties. A method is given for extending the data to neighboring frequencies. Use of the method was successful for all portions of the complex index of refraction plane except for small values of the extinction coefficient. Author (NSA)

N76-26991# Honeywell Radiation Center, Lexington, Mass.
THE 10.6 MICRON (Hg,Cd)Te PHOTODIODE MODULE Interim Report, 15 Jun. 1973 - 15 Aug. 1974
T. Koehler Ft. Monmouth, N. J. ECOM Oct. 1975 32 p ref
(Contract DAAB07-71-C-0236; DA Proj. 1S7-62703-DH-93)
(AD-A019211; ECOM-71-0236-2; IR-2) Avail: NTIS CSCL 17/5

This report describes the development of a 10.6 micrometers (Hg,Cd)Te thermoelectrically cooled detector module operating at 146 K. The first six months of this program demonstrated the feasibility of 146 K operation by achieving photodiodes with quantum efficiency of 55%, bandwidth of 156 MHz and saturation current of 3 mA at 146 K. The present phase of the program demonstrates the operation of a nine-stage thermoelectric cooler and the TE cooler-detector interface. CO2 laser heterodyne measurements were performed on the unit by AIL division of Cutler-Hammer, Inc., with resultant NEP of 2 x 10 to the minus 13th power W/Hz at 177 K. The cooler did not attain 146 K in the laser tests because of the large detector package surface area and consequently large radiant heat load. The low performance at 10.6 micrometers was attributed to a spectral cutoff wavelength shift of the detector when operated at 177 K instead of 146 K. The nine-stage cooler was found inefficient, requiring 87 watts input power. Because of high quantum efficiencies observed from blackbody measurements at 175 K, it is recommended that a detector be optimized for 10.6 micrometers at 170 K utilizing a six-stage TE cooler requiring less than 20 watts operating power. Author (GRA)

N76-26992# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
ON THE IMAGING OF INCOHERENT OBJECTS IN A TURBULENT MEDIUM Physical Sciences Research Papers
Ronald L. Fante 14 Oct. 1975 33 p refs
(AF Proj. 2153)
(AD-A019805; AFCRL-TR-75-0546; AFCRL-PSRP-647) Avail: NTIS CSCL 20/6

It is demonstrated that, in turbulence, intensity interferometry and the related Labeyrie method give accurate (spatial) spectral information only about incoherent sources which are smaller than the spherical wave coherence length, rho sub 0. It is simultaneously shown that the isoplanatic distance in turbulence is approximately equal to rho sub 0. GRA

N76-26993# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ABSOLUTE LENGTH CHANGES BY REMOTE INTERFEROMETRY Interim Report
Ernest G. Wolff and Steven A. Eselun 10 Dec. 1975 47 p refs
(Contract F04701-75-C-0076)
(AD-A019666; TR-0076(6950-07)-1; SAMSO-TR-75-C-0076) Avail: NTIS CSCL 20/6

The subject of remote or 'contactless' length change measurements is reviewed. The development of a Michelson-type laser interferometer is described. Fringe analysis and system requirements to achieve continuous real-time delta l/l versus temperature curves with a resolution of less then 10 A are outlined. Author (GRA)

N76-26994# Technology Service Corp., Santa Monica, Calif.
SIMULATION TECHNIQUES FOR AIRBORNE ELECTRO-OPTICAL IMAGING SYSTEMS Final Report, Apr. 1974 - Jan. 1975
Jeffery W. Bell, Ivan R. Bottlik, and Antonio B. Lucero Dec. 1975 150 p refs
(Contract F33615-75-C-4069; AF Proj. 6114)
(AD-A020090; TSC-PD-125-13; AFHRL-TR-75-43) Avail: NTIS CSCL 17/5

The purpose of this study was to develop a computer software package to simulate airborne electro-optical imagery systems in nonreal time. The results of the study include a computer program that can be used as a research tool in conjunction with a long-range program for the development of sensor simulator technology and a set of techniques, algorithms, and design guidelines to be used in developing an interactive real-time simulator system. The study encompassed three main areas. These were data base generation, mathematical model formulation, and algorithm and software development. The simulation program is designed to simulate three target areas under many different weather (visibility and water vapor content) and daytime conditions. The inputs to the program allow the operator to choose a flight profile. The program then creates and displays a set of representative pictures of the target in a simulated flyby. GRA

N76-26995# IBM Federal Systems Div., Westlake Village, Calif.
DSSS/VL (DEEP SPACE SURVEILLANCE SATELLITE/VISIBLE LIGHT) ON-BOARD DATA PROCESSING DEFINITION STUDY. VOLUME 1: SUMMARY Final Report, Mar. - Dec. 1975
Nov. 1975 60 p refs
(Contract F04701-75-C-0110)
(AD-A019596; SAMSO-TR-75-260-Vol-1) Avail: NTIS CSCL 17/8

This document, Volume I of the Deep Space Surveillance Satellite/Visible Light On-Board Data Processing Definition Study Final report, contains a summary of the project which encompassed design, implementation and characterization of selected sensor data processing algorithms within a digital simulation system. Subjects include an introduction and background, technical approach, simulation development, characterization results, major conclusions and recommendations. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N76-26996 Iowa Univ., Iowa City.
SIMULATION OF PARAMETRIC INSTABILITY EFFECTS IN A BEAM PLASMA SYSTEM Ph.D. Thesis
Richard Forest Hubbard 1975 231 p
Avail: Univ. Microfilms Order No. 76-13396

An energetic electron beam produces large amplitude resonant plasma oscillations which can parametrically decay into growing nonresonant electron and ion waves if ion dynamics are included. A similar parametric instability occurs in a plasma driven by a high frequency external electric field. A two-specie particle simulation study of beam generated parametric instabilities is presented and the results compared with corresponding one-specie beam and external field simulations. For low beam densities the individual nonresonant modes grow approximately at the rates predicted by parametric instability theory. This growth eventually causes the resonant plasma oscillations to decay exponentially at a rate proportional to the original parametric growth rate. The velocity diffusion coefficient has been measured from test particle dynamics, and beam plasmas driven by an external field were simulated. Dissert. Abstr.

N76-26997 Georgia Inst. of Tech., Atlanta.
THE INFLUENCE OF ELECTROPHILIC ADDITIVES ON PLASMA ARC JETS Ph.D. Thesis
P. Chacko Zachariah 1975 94 p
Avail: Univ. Microfilms Order No. 76-13782

The fundamental reason for the enthalpy and efficiency limits of plasma arc jets is the high electrical conductivity of the arc column plasma and its rapid increase with increasing temperature. Injection of electrophilic compounds into the arc column plasma depletes the free electrons in the plasma and hence decreases its electrical conductivity. The effectiveness of electrophilic additive injection into the arc column plasma in reducing the arc column conductivity and increasing the arc jet enthalpy and efficiency was investigated. Experiments were conducted in a 300 kW, d.c., plasma arc jet facility with argon as the arc gas and sulfur

hexafluoride and carbon tetrafluoride as the electrophilic additives, for a temperature range of 5500 to 12,200 K. Small quantities of these electrophilic additives were injected into the arc column plasma and enthalpies and efficiencies with and without the additives were determined by a calorimetric approach.
Dissert. Abstr.

N76-26998 California Univ., Irvine.
PLASMA HEATING WITH ROTATING RELATIVISTIC ELECTRON BEAMS Ph.D. Thesis
Kim Molvig 1975 168 p
Avail: Univ. Microfilms Order No. 76-13867

One of the remaining problems in the control of thermonuclear fusion is the development of a suitable method of bringing the plasma to ignition temperature. Relativistic electron beams provide a possible technique. They are a well developed and readily available technology with power levels sufficient to meet the demanding requirements of plasma heating. An advantageous configuration utilizes a beam rotating about a guide magnetic field. For such a beam a theory was developed for the interaction in two stages. The first stage treats the plasma response induced by the propagating beam. Plasma return currents neutralize both the axial and azimuthal beam current. Induced fields slow the beam, trapping it in the plasma. After dissipating a small fraction of its energy during trapping, the second stage of plasma heating begins. The beam rotating within the plasma emits a magnetosonic shock type wave. Dissert. Abstr.

N76-26999 California Univ., Irvine.
PLASMA HEATING IN A LONG SOLENOID BY A LASER OR A RELATIVISTIC ELECTRON BEAM Ph.D. Thesis
Toshiki Tajima 1975 280 p
Avail: Univ. Microfilms Order No. 76-13868

Linear and nonlinear theories were used to study the anomalous reflection process for the Laser/Long Solenoid (LS) case. One critical process is the parametric Brillouin backscattering instability. A nonlinear stage of this instability was studied. Many possible mechanisms for suppression of the instability were considered and found inadequate except for one, namely the saturation by ion shock formation. Shock formation tends to offset the grating effect of the ion density ripple for the laser light. This was analyzed by finding a small expansion parameter (the growth rate of the instability) and utilizing a systematic multiple scale theory expansion. The backscattering saturates at a low level for the typical LS parameters. Dissert. Abstr.

N76-27000 Wisconsin Univ., Madison.
DIFFUSION IN THE LEVITATED TOROIDAL OCTUPOLE Ph.D. Thesis
James Robert Greenwood 1975 212 p
Avail: Univ. Microfilms Order No. 76-6088

A detailed study of particle transport due to diffusion processes in the pulsed magnetic field toroidal octupole was carried out for gun injected plasmas. A model was developed from Fick's law in the toroidal octupole geometry which predicts the shape and time evolution of the density profile in the octupole. A general profile 'shape' equation is derived from a parameterized diffusion coefficient. Comparison of the 'shape' equation and time evolution equations to experimental observations allowed the scaling of the diffusion coefficient with density, temperature and magnetic field to be determined. The levitated octupole has the ability to remove the supports to the hoops during the time of the experiments. This feature was used in a preliminary series of experiments to determine the effects of the supports on the diffusion coefficient. The diffusion coefficients in the region where the magnetic field lines circle all four hoops were found to be larger than and different scaling than the respective convective diffusion coefficients. Dissert. Abstr.

N76-27001 California Univ., Davis.
LASER LIGHT SCATTERING AND ABSORPTION IN DENSE, SPHERICALLY SYMMETRIC PLASMA Ph.D. Thesis
John Howe Erkkila 1975 138 p
Avail: Univ. Microfilms Order No. 76-14203

A computational study of the interaction of a focused laser beam with a dense, spherically symmetric plasma is described. The plasma is treated using linearized fluid equations for the electrons, with the ions assumed immobile; the electromagnetic field is determined from steady state solutions to Maxwell's equations in spherical coordinates. Energy dissipation in the plasma occurs as a result of inverse bremsstrahlung collisions and reasonance absorption. The scattered field distribution and the spatial variation of the fields and energy deposition within the plasma are found for various-plasma configurations and the applicability of the theory as a function of plasma temperature and laser power is determined with a self-consistent analysis.
Dissert. Abstr.

N76-27002 Rensselaer Polytechnic Inst., Troy, N.Y.
UTILITY OF AN ION BEAM PROBE DIAGNOSTIC FOR FLUCTUATION STUDIES IN HIGH ENERGY DENSITY, MAGNETICALLY CONFINED PLASMAS Ph.D. Thesis
John C. Glowienka 1975 171 p
Avail: Univ. Microfilms Order No. 76-13735

A heavy ion beam probe has been shown to be an attractive diagnostic tool for measuring fluctuating parameters in high energy density, magnetically confined plasmas. Techniques were developed that provide accurate, simultaneous measurements of the amplitude and phase of both density and space potential fluctuations. The measurements are made with a spatial resolution of 0.1 cu/cm. and time resolution (currently limited by the electronics) of 10 microsec. The new techniques were used to identify a coherent oscillation in an energetic arc plasma as a Kelvin-Helmholtz flute driven by nonuniform Er x Bz plasma rotation. The mode was identified by its localization in a region of Er x Bz velocity shear, the relative magnitudes of density and space potential oscillations, and the range of the phase difference between density and space potential oscillations across the plasma. Dissert. Abstr.

N76-27003 California Inst. of Tech., Pasadena.
THE DEVELOPMENT AND CHARACTERIZATION OF AN ATMOSPHERIC PRESSURE NONEQUILIBRIUM PLASMA CHEMICAL REACTOR Ph.D. Thesis
Kevin Gerard Donohoe 1976 275 p
Avail: Univ. Microfilms Order No. 76-14248

An atmospheric pressure nonequilibrium electrical discharge system that would be suitable for use as a plasma chemical reactor was investigated. Electrical discharge with voltage and current measurements were characterized. The effect of the poisoning of an atmospheric pressure discharge by NO2, a product of the discharge in air was examined. A pulsed discharge circuit which can produce nonequilibrium electrical dicharges in gases at atmospheric pressure has been developed. Volumetric glow discharges in helium were produced with an electrode configuration which limited, but did not eliminate, secondary processes at the cathode. The largest volumetric discharge produced in helium was 5 cm. in diameter and 8 cm. long. Peak discharge power with this electrode configuration was nearly 20 kilowatts. An annular discharge between parallel disc electrodes was produced for electrode gaps up to 10 cm. in helium at atmospheric pressure. Peak discharge power was approximately 0.2 megawatts. Dissert. Abstr.

N76-27004*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
MAGNETIC DYNAMO ACTION IN TWO-DIMENSIONAL TURBULENT MAGNETO-HYDRODYNAMICS
David Fyfe, Glenn Joyce, and David Montgomery Jun. 1976 39 p refs Sponsored in part by NSF Prepared in cooperation with Natl. Center for Atmospheric Res.
(Grant NGL-16-001-043; Contract AT(11-1)-2059)
(NASA-CR-148291) Avail: NTIS HC $4.00 CSCL 20I

Two-dimensional magnetohydrodynamic turbulence is explored by means of numerical simulation. Previous analytical theory, based on non-dissipative constants of the motion in a truncated Fourier representation, is verified by following the evolution of highly non-equilibrium initial conditions numerically. Dynamo action (conversion of a significant fraction of turbulent kinetic energy into long-wavelength magnetic field energy) is observed. It is conjectured that in the presence of dissipation and external forcing, a dual cascade will be observed for zero-helicity situations. Energy will cascade to higher wave numbers simultaneously with a cascade of mean square vector potential to lower wave numbers, leading to an omni-directional magnetic energy spectrum which varies as 1/k 3 at lower wave

numbers, simultaneously with a buildup of magnetic excitation at the lowest wave number of the system. Equipartition of kinetic and magnetic energies is expected at the highest wave numbers in the system. Author

N76-27005# Princeton Univ., N.J. Plasma Physics Lab.
FILAMENTATION INSTABILITY OF LOWER HYBRID WAVES IN A PLASMA
P. K. Kaw Feb. 1976 12 p refs
(Contract E(11-1)-3073)
(MATT-1208) Avail: NTIS HC $3.50

It is shown that a strong lower hybrid wave is modulationally unstable to perturbations propagating along its own wave vector. The instability relies critically on the finite thermal corrections to the lower hybrid dispersion relation. Author (ERA)

N76-27006# Princeton Univ., N.J. Plasma Physics Lab.
UPPER HYBRID SOLITONS AND OSCILLATING-TWO-STREAM INSTABILITIES
M. Porkolab and M. V. Goldman Dec. 1975 48 p refs
(Contract W(11-1)-3073)
(MATT-1157) Avail: NTIS HC $4.00

A warm two-fluid theory of soliton formation near the upperhybrid frequency is developed. Several forms of the nonlinear Schroedinger equation are obtained, depending on whether the electric field is completely perpendicular to the dc magnetic field or whether it has an additional small component parallel to the magnetic field. For the perpendicular case, the character of the soliton depends on its scale length, L, and on beta. For low beta, when L is less than c/omega sub pe stationary envelope and hole solitons are found, whereas when L is greater than c/omega sub pi, super-Alfvenic solitons are obtained. Stenflow by MHD theory. However, the case E/sub parallel/not equal to 0 may be of more interest, since it couples the pump to the excited waves more efficiently. In the limit of linearization about an infinite wavelength pump, the nonlinear Schroedinger equations yield purely growing (oscillating-two-stream) instabilities in both cases. Author (ERA)

N76-27007# Princeton Univ., N.J. Plasma Physics Lab.
FAULT PROTECTION FOR NEUTRAL-BEAM INJECTION SYSTEMS
R. C. Knauer, D. L. Ashcroft, J. G. Murray, and R. A. Newman Dec. 1975 13 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego
(Contract E(11-1)-3073)
(MATT-1179; Conf-751125-117) Avail: NTIS HC $4.00

This paper discusses the accelerating or main supply for the Neutral Injection System on a plasma fusion research device (plasma gun) and, in particular, provides evaluation of a system for protection against the possibility of an electric arc developing in the accel portion of the ion source gun. The design of a protection scheme utilizing a fast turn-on and turn-off ignitron crowbar is described and evaluated. This crowbar is used to provide backup protection for the ion source high power vacuum tube used as a voltage regulator and series switch. Ignitron crowbars are proposed for use as primary protection of the 150 KV ion source being developed for the Tokamak Fusion Test Reactor if a 150 KV switch tube is not readily available and inexpensive. Author (NSA)

N76-27008# Los Alamos Scientific Lab., N.Mex.
FINAL INSTALLATION AND TESTING OF THE FEEDBACK POWER AMPLIFIER FOR THE SCYLLAC FEEDBACK EXPERIMENT
K. J. Kutac, R. W. Kewish, Jr., R. F. Rawcliffe, A. S. Miller, E. L. Kemp, and R. R. Bartsch 1975 10 p refs Presented at the IEEE Sixth Symp. on Eng. Probl. of Fusion Res., San Diego, Calif. 17 Nov. 1975
(Contract W-7405-eng-36)
(LA-UR-75-2183; Conf-751125-53) Avail: NTIS HC $4.50

The Scyllac feedback system consists of eight subsystems. The installation and testing of the many components and eight subsystems are described. The eight subsystems are: (1) ML-8618 power amplifiers; (2) dc plate and bias power supplies; (3) ac filament power supplies; (4) position detector and signal processor (intermediate amplifier); (5) 1 = 0 and 1 = 2 output load coils; (6) control system and interlock system; (7) computer controlled analog-to-digital transient recorders; and (8) cable distribution and cooling-water supply system. Author (ERA)

N76-27009# Los Alamos Scientific Lab., N.Mex.
SCYLLAC EQUIPMENT RELIABILITY ANALYSIS
W. D. Gutscher and K. J. Johnson 1975 5 p refs Presented at the IEEE Sixth Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 17 Nov. 1975
(Contract W-7405-eng-36)
(LA-UR-75-2158; Conf-751125-55) Avail: NTIS HC $4.50

Most of the failures in Scyllac can be related to crowbar trigger cable faults. A new cable was designed, procured, and is currently undergoing evaluation. When the new cable has been proven, it will be worked into the system as quickly as possible without causing too much additional down time. The cable-tip problem may not be easy or even desirable to solve. A tightly fastened permanent connection that maximizes contact area would be more reliable than the plug-in type of connection in use now, but it would make system changes and repairs much more difficult. The balance of the failures has such a low occurrence rate that it does not cause much down time and no major effort is underway to eliminate it. Even though Scyllac was built as an experimental system and has many thousands of components, its reliability is very good. Author (ERA)

N76-27010# Los Alamos Scientific Lab., N.Mex.
IMPLOSION HEATING IN THE SCYLLAC FUSION TEST REACTOR
R. K. Lindord, W. C. Nummally, and K. I. Thomassen 1975 6 p refs Presented at the IEEE Sixth Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 17 Nov. 1975
(Contract W-7405-eng-36)
(LA-UR-75-2154; Conf-751125-52) Avail: NTIS HC $4.50

The Scyllac Fusion Test Reactor (SFTR) is a large radius toroidal theta pinch experiment. The SFTR is designed for D-T operation to achieve Q = 1, i.e., the total neutron energy at 20 Me/neutron is equal to the internal energy of the plasma with an expected average confinement time of the plasma in the range of 200 ms. It is one of the most important and technologically challenging systems in the implosion heating system. This system provides the implosion heating field which must rise to approximately 8 kG in 100 to 200 ns and then crow barred with a sufficently long L/R time to allow the compression field to be brought up. The system employs 54-kV capacitors as the energy source arranged in a low inductance configuration in order to obtain a short risetime with a minimum of voltage and energy. Author (ERA)

N76-27011# Oak Ridge National Lab., Tenn.
LARGE SUPERCONDUCTING COIL FABRICATION DEVELOPMENT
R. L. Brown, E. L. Allred, W. C. Anderson, P. B. Burn, R. I. Deaderick, and E. F. Marguerat 1975 5 p refs Presented at the Sixth IEEE Symp. on Eng. Probl. of Fusion Res., San Diego, Calif. 17 Nov. 1975 Sponsored by ERDA
(CONF-751125-42) Avail: NTIS HC $4.50

Toroidal fields for some fusion devices are being produced by an array of large superconducting coils. Their size, space limitation, and field requirements dictate that they be high performance coils. Once installed, accessibility for maintenance and repairs is severely restricted; therefore, good reliability is an obvious neccessity. Sufficient coil fabrication is planned to develop and test methods that are reliable, fast, and economical.
Author (ERA)

N76-27012# Oak Ridge National Lab., Tenn.
TRANSIENT POLOIDAL FIELD EFFECTS IN TWISTED MULTIFILAMENTARY SUPERCONDUCTOR FOR TOROIDAL FIELD WINDINGS OF TOKAMAKS
S. S. Shen and J. R. Miller 1975 8 p refs Presented at the Sixth IEEE Symp. on Eng. Probl. of Fusion Res., San Diego, Calif. 17 Nov. 1975 Sponsored by ERDA
(CONF-751125-39) Avail: NTIS HC $4.50

A circuit model is presented for a twisted filamentary superconductor exposed to a pulsed parallel external field. Experimental results are also reported on the measurements of transient loss voltage and its change due to transport current.

The measurements are in reasonable agreement with that predicted by the postulated model. Author (ERA)

N76-27013# Oak Ridge National Lab., Tenn.
TOROIDAL FIELD RIPPLE EFFECTS IN LARGE TOKAMAKS
N. A. Uckan, K. T. Tsang, and J. D. Callen 1975 5 p refs Presented at the Sixth IEEE Symp. on Eng. Probl. of Fusion Res., San Diego, Calif. 17 Nov. 1975 Sponsored by ERDA
(CONF-751125-8) Avail: NTIS HC $4.50

In an experimental power reactor, the ripple produced by the finite number of toroidal field coils destroys the ideal axisymmetry of the configuration and is responsible for additional particle trapping loss regions and plasma transport. The effects of toroidal field ripple on the plasma transport coefficient, the loss of alpha particles and energetic injection ions, and the relaxation of toroidal flows are investigated in a new and systemic way. The relevant results are applied to the ORNL-EPR reference design; the maximum ripple there of about 2.2 percent at the outer edge of the plasma column is found to be tolerable from plasma physics considerations. Author (ERA)

N76-27014# California Univ., Livermore. Lawrence Livermore Lab.
CONTROLLED THERMONUCLEAR RESEARCH Annual Report, Jul. 1973 - Jun. 1974
15 Oct. 1974 92 p refs
(Contract W-7405-eng-48)
(UCRL-50002-74) Avail: NTIS HC $5.45

The Controlled Thermonuclear Research (CTR) program was marked by two major changes in the course of the experimental program: the adaption of high-power neutral beam heating in the 2X experiment, and the decision to change the startup mode in the Baseball 2 experiment to one in which a laser pellet technique is used to produce a transient, high-density target plasma. Supporting research centered on technologies vital to the mirror confinement program, e.g., development of intense neutral beams, of high-field superconducting magnets, and of direct energy conversion. In addition, a preliminary design study of fusion-fission hybrid systems was completed, as was a parametric study of mirror fusion reactors. The diverse experience of LLL in nuclear physics and materials research was applied to continuing 14-MeV neutron studies and tritium research. Author (ERA)

N76-27015# Oak Ridge National Lab., Tenn.
DESCRIPTION OF A REFERENCE DESIGN TOKAMAK FOR THE TECHNOLOGY TEST ASSEMBLY
P. N. Haubenreich Oct. 1975 125 p refs
(Contract W-7405-eng-26)
(ORNL-TM-4820) Avail: NTIS HC $5.45

Early conceptual studies for the technology test assembly involved a reference conceptual design for a Tokamak with superconducting toroidal field magnets. The TF magnet conductors are NbTi filaments in a copper matrix. The 24 TF coils and associated structure operate at 4-5 K and a maximum field (at the windings) of 75 kG. Principal dimensions of the machine are: TF coil bore, 1.8 x 2.4 m (oval); major radius, 2.25 m; plasma minor radius, 0.6 m. A preliminary but detailed cost estimate for the reference machine was prepared to serve as an anchor point for cost scaling for larger machines in subsequent TTA parameter studies. Author (ERA)

N76-27016# Princeton Univ., N.J. Plasma Physics Lab.
CONFERENCE REPORT FOR NUCLEAR FUSION PHENOMENA IN IONIZED GASES
M. Porkolab Oct. 1975 14 p Presented at the Conf. on Phenomena in Ionized Gases, Eindhoven, the Netherlands
(Contract E(11-1)-3073)
(MATT-1174) Avail: NTIS HC $4.00

A summary of the Conference on Phenomena in Ionized Gases, held in Eindhoven, the Netherlands, is given. In particular, the format of the conference and the content of the review papers and lectures are summarized. Author (ERA)

N76-27017# Princeton Univ., N.J. Plasma Physics Lab.
SATURATION OF THE PARAMETRIC DECAY INSTABILITY NEAR THE LOWER HYBRID FREQUENCY
L. Chen and R. L. Berger Oct. 1975 13 p refs
(Contract E(11-1)-3073)
(MATT-1169) Avail: NTIS HC $4.00

The nonlinear evolution and saturation of parametrically excited lower hybrid waves are studied numerically by solving the corresponding weak turbulence wave kinetic equation. The saturation level and the effective collision frequency v/sub f/ are obtained as functions of pump power. Plasma heating by landau damping and radiofrequencies is specifically examined. Author (ERA)

N76-27018# California Univ., Livermore. Lawrence Livermore Lab.
FROZEN AMMONIA MICROPELLET GENERATOR FOR BASEBALL 2-T
B. S. Denhoy 28 Oct. 1975 7 p refs Presented at IEEE Symp. on Eng. Probl. of Fusion Res.
(Contract W-7405-eng-48)
(UCRL-77230; Conf-751125-6) Avail: NTIS HC $4.50

A startup plasma at the center of the Baseball II-T magnet was studied. This startup plasma will be used as a target for high energy neutral beams to achieve the required build-up. The target plasma will be created by irradiating a solid pellet with a laser beam. Although a deuterium pellet would be superior because of purity, the development of an ammonia pellet was undertaken because it requires a simpler technology. The ammonia target plasma is physically acceptable for the initial experiment. A frozen ammonia pellet, about 100 microns in diameter, will be irradiated with 300-J CO2 laser, to produce a density of about 10 to the 13th power/cubic and about 1 kV temperature. Author (ERA)

N76-27019# Princeton Univ., N.J. Plasma Physics Lab.
SMALL-SCALE DENSITY FLUCTUATIONS IN THE ADIABATIC TOROIDAL COMPRESSOR
E. Mazzucato Feb. 1976 10 p refs
(Contract E(11-1)3073)
(MATT-1195) Avail: NTIS HC $4.00

A new class of density fluctuations has been observed in the ATC Tokamak by using spectral analysis of scattered microwaves. The observed frequency spectrum is consistent with that of drift waves with amplitudes that are maximum in the wavelength range 0.5 to 1.0 cm where finite ion Larmor radius effects are important for plasma stability. The total density fluctuation is n tilde/sub e/ greater than or equal to 5 x 0.001 anti n/sub e/. It is estimated that these fluctuations could account for a large fraction of the electron energy losses of the ATC discharge. Author (NSA)

N76-27020# Princeton Univ., N.J. Plasma Physics Lab.
WAVEGUIDE AND LOOP COUPLING TO FAST MHD TOROIDAL EIGENMODES
F. J. Paoloni Dec. 1975 28 p refs
(Contract E(11-1)-3073)
(MATT-1173) Avail: NTIS HC $4.00

Heating of plasmas by wave techniques requires an effective method of coupling RF energy to the plasma. In cavities the presence of weakly damped eigenmodes enhances the loading of antennas when the wave frequency equals an eigenmode frequency. This report considers two methods of coupling to fast MHD eigenmodes in a toroidal cavity: one is by a waveguide mounted perpendicular to the vacuum vessel wall; and the other by a loop placed within the cavity. Author (NSA)

N76-27021# Oak Ridge National Lab., Tenn.
LINEARIZED GYRO-KINETIC EQUATION
P. J. Catto and K. T. Tsang Jan. 1976 28 p refs
(Contract W-7405-eng-26)
(ORNL-TM-5237) Avail: NTIS HC $5.00

An ordering of the linearized Fokker-Planck equation is performed in which gyroradius corrections are retained to lowest order and the radial dependence appropriate for sheared magnetic fields is treated without resorting to a WKB technique. This description is shown to be necessary to obtain the proper radial dependence when the product of the poloidal wavenumber and the gyroradius is large (k rho much greater than 1). A like particle collision operator valid for arbitrary k rho also has been derived. In addition, neoclassical, drift, finite beta (plasma

pressure/magnetic pressure), and unperturbed toroidal electric field modifications are treated. Author (NSA)

N76-27022# Los Alamos Scientific Lab., N.Mex.
DESCRIPTION OF COLLISIONLESS PLASMAS BY CLASSICAL FIELD EQUATIONS
G. S. Fraley Oct. 1975 7 p refs
(Contract W-7405-eng-36)
(LA-6136) Avail: NTIS HC $4.50

Classical field equations are derived from quantum fields to obtain a different and possibly simpler description of a collisionless plasma. The method is to take the simultaneous limit, Dirac constant, e, m yields 0, of charged scalar fields and the electromagnetic field. Laplace transforms for perturbations in a uniform relativistic plasma are compared with corresponding results from the Maxwell-Vlasov equations. For the nonlinear case, a distribution function defined on the classical fields is shown to satisfy the Vlasov equation. Author (ERA)

N76-27023# Los Alamos Scientific Lab., N.Mex.
SLOWING-IN DISTRIBUTION OF FAST PARTICLES RELEASED IN MAXWELLIAN PLASMA
A. A. Husseiny, Z. A. Sabri, and D. R. Harris May 1975 19 p refs
(Contract W-7405-eng-36)
(LA-5988) Avail: NTIS HC $4.00

The time-independent slowing-in distribution is evaluated for a fast beam of test particles released in an infinite Maxwellian plasma background for various situations including quantum-mechanical and classical scattering regimes. The analysis involves considerations of small angle deflection and large angle scattering events. The results are determined for plasma electrons with thermal velocities larger or smaller than the test particle and plasma ions with thermal velocities lower than the test particle. When plasma electrons and ions are slow the slowing-in distribution behaves as E/sub j//sup 1/2/, where E/sub j/ is the test particle energy. When plasma electrons are faster than the test particles, the high-energy tail acquires a 1/E/sub j/ shape. The origin of the test particle remains arbitrary and hence the results apply to particles produced by fusion events within the plasma proper and to particles externally injected. The total energy distribution is obtained and normalized, and ranges of validity are determined. Author (ERA)

N76-27024# Japan Atomic Energy Research Inst., Tokai.
MULTI-CHANNEL NEUTRAL PARTICLE ENERGY ANALYZER FOR MEASURING ION TEMPERATURES IN TOKAMAK PLASMAS
H. Takeuchi Mar. 1975 18 p In JAPANESE
(JAERI-M-6048) Avail: ERDA Depository Libraries HC $4.50

A multi-channel neutral particle energy analyzer has been constructed for reducing the time of measurement and improving the accuracy of measurement in Tokamak plasmas. It consists of a charge stripping cell, a 10-channel electrostatic energy analyzer and an ion detector. The maximum number of detected particles in the analyzer is one million cps. Energy calibration of the electrostatic energy analyzer was made with an electron beam, and transmission efficiency calibration was experimented with a proton beam. The analyzer was found to properly measure the ion temperatures in Tokamak plasmas. The stripping cell efficiency for H2 gas was also measured; the value is in agreement with that calculated from the charge-stripping and charge-exchange cross sections. Author (NSA)

N76-27025# Cornell Univ., Ithaca, N.Y.
INJECTION, COMPRESSION AND STABILITY OF INTENSE ION-RINGS
R. N. Sudan 1975 23 p refs Presented at the 7th European Conf. on Controlled Fusion and Plasma Phys., Lausanne, Switzerland, 1-5 Sep. 1975
(Contract AT(11-1)-3170)
(CONF-750905-23) Avail: NTIS HC $3.50

Recent advances in pulsed high power ion beam technology make possible the creation of intense ion-rings with strong self-magnetic fields by single pulse injection. Such ion rings have several uses in controlled fusion e.g., to produce a min parallel B parallel magnetic geometry with a mirror ratio much higher than is possible with external conductors. For even stronger ion rings a min parallel B parallel with closed lines of force (ASTRON type) can be created. For this purpose, since the ion energies required are much higher than are available from high power sources, magnetic compression can be utilized to increase the ion energy. The success of this scheme depends critically on the stability of the ion ring. The low frequency perturbations of the ring-plasma system are examined by means of a generalization of the energy principle which established sufficient conditions for stability. The high-frequency micro-instabilities and their nonlinear consequences are discussed in terms of conventional techniques. Author (ERA)

N76-27026# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France).
ION TEMPERATURE IN THE TFR TOKAMAK
Jul. 1975 34 p refs
(EUR-CEA-FC-778) Avail: ERDA Depository Libraries HC $4.00

Measurements of the T.F.R. plasma ion temperature over a wide range have shown that the ion energy balance can be explained by losses following a 'plateau' dependence, the ion-ion collision frequency being increased by the presence of impurities. No observation of a banana like conduction loss has been found even for a 1 keV ion temperature plasma. Author (ERA)

N76-27027# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Dept. de Physique du Plasma et de la Fusion Controlee.
LINE RADIATION IN THE VISIBLE AND ULTRAVIOLET IN TFR TOKAMAK PLASMAS
Jul. 1975 67 p refs
(EUR-CEA-FC-777) Avail: ERDA Depository Libraries HC $4.50

Line radiation in the visible and ultraviolet (100 to 1300 A) spectral regions was studied on TFR for a 140 kA, 26 kG plasma. The emission is integrated along the line of sight, except for neutral deuterium visible radiation, which has been spatially resolved. From the measured absolute signals the initial (in the first ten milliseconds) amount of impurities was determined. Subsequently the observed signals were interpreted in terms of an impurity recycling flux. It was deduced from power balance considerations that this flux is confined to an external plasma shell, a small part only diffusing towards the center to account for the independently inferred Z. The power was radiated by the observed lines corresponds to an important fraction of the injected ohmic power. Two lines ascribed to MoXXXI and MoXXXII (and therefore originating in the central hot plasma core) were detected for electron temperatures greater than 1.5 keV. Author (ERA)

N76-27028# California Univ., Livermore. Lawrence Livermore Lab.
PRESENT STATUS OF MIRROR STABILITY THEORY
D. E. Baldwin, H. L. Berk, and J. A. Byers 11 Feb. 1976 63 p refs
(Contract W-7405-eng-48)
(UCID-17038) Avail: NTIS HC $5.45

A status report of microinstability as it applies to 2XIIB and MX theory for mirror machines is presented. It is shown that quasilinear computations reproduce many of the parameters observed in the 2XIIB experiment. In regard to large mirror machines, there are presented detailed calculations of the linear theory of the drift cyclotron loss-cone mode, with inhomogeneous geometry and nonlinear diffusive effects. Further, the stability of a mirror machine to the Alfven ion-cyclotron instability is assessed, and the Baldwin-Callen diffusion is estimated for a spatially varying plasma. Author (ERA)

N76-27029# California Univ., Livermore. Lawrence Livermore Lab.
STATUS OF 2XIIB PLASMA CONFINEMENT EXPERIMENTS
F. J. Coensgen, J. F. Clauser, D. L. Correll, W. F. Cummins, C. Gormezano, B. G. Logan, A. W. Molvik, W. E. Nexsen, T. C. Simonen, B. W. Stallard et al 11 Feb. 1976 76 p refs
(Contract W-7405-eng-48)
(UCID-17037) Avail: NTIS HC $5.00

The status of 2XIIB neutral beam injection experiments with stabilizing plasma is described. The stream suppresses ion-

cyclotron fluctuations and permits denisty to 5 x ten to the 13th power /cu cm. The ion energy is 13 keV, and electron temperature reaches 140 eV. Plasma confinement increases with ion energy and n tau reaches 7 x ten to the 13th power/cu cm 3 s at 13 keV. The n tau energy scaling is consistent with electron drag and ion-ion scattering losses. Buildup on a streaming plasma in a steady-state magnetic field is described.
Author (NSA)

N76-27030# California Univ., Livermore. Lawrence Livermore Lab.
COUPLED MHD-MONTE CARLO TRANSPORT MODEL FOR DENSE PLASMAS Ph.D. Thesis
W. P. Chandler Jun. 1975 104 p refs
(Contract W-7405-eng-48)
(UCRL-52009) Avail: NTIS HC $5.45

A two-dimensional, two fluid model of the MHD equations was coupled to a Monte Carlo transport model of high energy, nonMaxwellian ions. The MHD part of the model assumed complete ionization and included a perfect gas law for a scalar pressure, a tensor artificial viscosity, electron and ion thermal conduction, electron-ion coupling, and a radiation loss term. A simple Ohm's Law was used with a B/sub theta/ magnetic field. The MHD equations were solved in Lagrangian coordinates. The conservation equations were differenced explicitly and the diffusion-type equations implicitly used the splitting technique. The Monte Carlo model solves the equation of motion for high energy ions, moving through and suffering small and large angle collisions with the fluid Maxwellian plasma. The source of high energy ions is the thermonuclear reactions of the hydrogen isotopes, or it may be an externally injected beam of neutralized ions. Author (ERA)

N76-27031# California Univ., Livermore. Lawrence Livermore Lab.
VOA: A 2-d PLASMA PHYSICS CODE
P. G. Eltgroth Dec. 1975 38 p refs
(Contract W-7405-eng-48)
(UCID-16830-Rev-1) Avail: NTIS HC $4.00

A two dimensional relativistic plasma physics code was written and tested. The non-thermal components of the particle distribution functions are presented by expansion into moments in momentum space. These moments are computed directly from numerical equations. Currently three species are included: electrons, ions and beam electrons. The computer code runs on either the 7600 or STAR machines at LLL. Both the physics and the operation of the code are discussed. Author (ERA)

N76-27032# California Univ., Livermore. Lawrence Livermore Lab.
PHOTON-INDUCED GAS BREAKDOWN IN THE GAS-EMBEDDED Z-PINCH
J. L. Eddleman and C. W. Hartman Jan. 1976 20 p refs
(Contract W-7405-eng-48)
(UCID-16992) Avail: NTIS HC $4.00

The breakdown of dense gas surrounding a thermonuclear temperature z-pinch is estimated. Restrictions on the pinch mass, driving electric field, and surrounding neutral gas density are obtained. Author (ERA)

N76-27033# California Univ., Berkeley. Lawrence Berkeley Lab.
MATHEMATICAL MODELS AND ALGORITHMS FOR THE COMPUTER PROGRAM WOLF
K. Halbach Dec. 1975 59 p refs
(Contract W-7405-eng-48)
(LBL-4444) Avail: NTIS HC $5.50

The computer program FLOW finds the nonrelativistic self-consistent set of two-dimensional ion trajectories and electric fields (including space charges from ions and electrons) for a given set of initial and boundary conditions for particles and fields. The combination of FLOW with the optimization code PISA gives the program WOLF, which finds the shape of the emitter which is consistent with the plasma forming it, and in addition varies physical characteristics such as electrode position, shapes, and potentials so that some performance characteristics are optimized. The motivation for developing these programs was the desire to design optimum ion source extractor/accelerator systems in a systematic fashion. The mathematical models and algorithms which approximate the real physical processes are derived. ERA

N76-27034# Oak Ridge National Lab., Tenn.
MAGNETIC SHIELDING SYSTEM FOR THE TOKAMAK EXPERIMENTAL POWER REACTOR
F. B. Marcus, Y. K. M. Peng, R. A. Dory, and J. R. Moore 1975 4 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego
(CONF-751125-40) Avail: NTIS HC $4.50

A poloidal field system is proposed for superconducting Tokamaks which magnetically shields the toroidal field coil windings from pulsed fields and reduces the plasma inductive requirements. The principal elements of the system are a primary air core winding and a shield-vertical-field winding. The properties of the system are investigated using computer codes for MHD equilibrium, inductances, and fields. Author (ERA)

N76-27035# California Univ., Livermore. Lawrence Livermore Lab.
BEAM-LINE CRYOPUMP
T. J. Duffy and L. D. Oddon 12 Nov. 1975 5 p Presented at the IEEE 6th Symp. on Eng. Prob. of Fusion Res., San Diego, Calif., 17-21 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77236; Conf-751125-22) Avail: NTIS HC $4.50

A cryopumping module using metallic surfaces at liquid helium temperature for condensation of hydrogen and deuterium gas has been constructed. The design point pumping capacity is 80,000 liters per second for hydrogen and deuterium at 0.0001 torr based on sticking coefficients of 0.15 and 0.25, respectively. Both the liquid helium temperature pumping surface and the liquid nitrogen temperature radiation shields are constructed of quilted double wall cylindrical shells. Cryogen circulation is convection current driven in both cases. Liquid helium is supplied from an overhead Dewar through bayonet coupling.
Author (ERA)

N76-27036# California Univ., Livermore. Lawrence Livermore Lab.
MECHANICAL DESIGN FOR NEUTRAL BEAM INJECTION
L. C. Pittenger 14 Nov. 1975 6 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 17-21 Nov. 1975
(Contract W-7405-eng-48)
(UCRL-77238; Conf-751125-24) Avail: NTIS HC $4.50

Two major neutral beam system designs were developed, the High Voltage Test Stand (HVTS) and a conceptual system for the Two Component Tokamak-Toroidal Fusion Test Reactor (TCT-TFTR). The HVTS was designed for flexibility in performing a wide variety of tests, while the TCT-TFTR beam line was designed to satisfy particular requirements for target plasma operation. Both designs make use of condensation cryopumping to handle very high gas loads. The HVTS design involves high voltage isolation techniques of cryogenic and other systems. The TCT-TFTR design requires optimization of pumping and other systems. Author (ERA)

N76-27037# Princeton Univ., N.J. Plasma Physics Lab.
VACUUM AND WALL PROBLEMS IN PRECURSOR REACTOR TOKAMAKS
S. A. Cohen Dec. 1975 53 p refs Presented at Natl. Vacuum Symp. Philadelphia, 28 Oct. 1975
(Contract E(11-1)-3073)
(MATT-1183; Conf-751023-6) Avail: NTIS HC $5.48

The Princeton large torus was completed in 1975 and two other CTR oriented toroidal plasma devices, the poloidal divertor experiment and the Tokamak fusion test reactor are planned to be completed in 1977 and 1981. The vacuum systems of these machines must satisfy stringent requirements because of unusual operating conditions, such as, magnetic field induced strains and eddy currents, energetic particle and photon bombardment, large transient gas loads, and the use of 100 Curie quantities of tritium. In addition, novel vacuum wall surfaces and fast moving mechanical or magnetic plasma limiters will be required to minimize the influx of impurities during discharges.
Author (NSA)

N76-27038# Oak Ridge National Lab., Tenn.
INFLUENCE OF THE MINOR PERIODICITY ON MAGNETIC ISLAND FORMATION IN TOKAMAKS
S. Matsuda Dec. 1976 27 p Sponsored by ERDA
(Contract W-7405-eng-26)
(ORNL-TM-5114) Avail: NTIS HC $5.00

The formation of magnetic islands due to external error fields is described. Magnetic fields due to the ohmic heating and vertical field coils that appear at the shell gaps make islands of significant size. Moreover, the toroidal minor periodicity of these perturbation fields, which is generally represented by the number of shell gaps, has an important meaning for suppression of the resonant magnetic islands. Author (ERA)

N76-27039# Japan Atomic Energy Research Inst., Tokai.
NUMERICAL METHOD TO OBTAIN THE OPTIMUM CONFIGURATION OF EXTERNAL MAGNETIC FIELD COILS IN A TOKAMAK DEVICE
Kazuo Toi and Tatsuoki Takeda Feb. 1975 40 p refs
(JAERI-M-6018) Avail: ERDA Depository Libraries HC $5.00

In large Tokamak devices in the next phase of fusion research, it seems that equilibrium of the toroidal plasma is maintained essentially by the external control loops and an air-core transformer is used instead of a conventional iron-core transformer. Under this situation the method based on the optimization process using the algorithm of a nonlinear programming has been applied in determination of the optimum design of the external magnetic field coils including the control loops for maintaining magnetic field and primary windings of the air-core transformer. It is found that the method is useful for design of the control loops and primary windings in a practical Tokamak. The results obtained so far are presented and the procedure of optimization is given in detail and comprehensively. Author (NSA)

N76-27040# California Univ., Livermore. Lawrence Livermore Lab.
STATUS REPORT ON MIRROR ALTERNATIVES
W. C. Condit, T. K. Fowler, and R. F. Post 3 Feb. 1976 56 p refs
(Contract W-7405-eng-48)
(UCRL-52008) Avail: NTIS HC $4.50

The present status of studies at Lawrence Livermore Laboratory (LLL) directed toward exploring variants on the basic magnetic mirror confinement concept is described. These studies have emphasized those ideas that could lead most directly to improvements in the scientific and economic viability of fusion reactors based on the mirror concept, within the general context of the extensive body of specialized physics and technology that has been developed in the course of the mirror program. Author (NSA)

N76-27041# Brookhaven National Lab., Upton, N.Y.
SURVEY OF DRIVEN TOKAMAKS IN EPR AND COMMERCIAL REACTOR APPLICATIONS
J. L. Usher and J. R. Powell 1975 16 p refs Presented at the IEEE 6th Symp. on Eng. Probl. of Fusion Res., San Diego, Calif., 17 Nov. 1975
(BNL-20727; Conf-751125-139) Avail: NTIS HC $3.50

Evaluation of plasma parameters of driven and ignited Tokamaks for use in experimental power reactor (EPR) and commercial reactor applications has been performed. The purpose of this study is to evaluate the most pessimistic conditions under which a power producing reactor could be operated assuming the use of a high efficiency power (HEP) cycle. The adoption of the HEP cycle will enable a power producing reactor to operate with a plasma Q of 1.5 or less as opposed to a required Q of approximately 8.0 utilizing a conventional conversion cycle. Q is defined as the ratio of thermal fusion power produced to beam input power required. Pessimistic assumptions of large impurity concentrations and short confinement times are made in order to determine the regimes of operation the HEP cycle would render accessible. Characteristic values of plasma and reactor parameters are listed for each of three reactor models for both EPR's and commercial reactors and the favorable implications of the HEP cycle are delineated. Author (NSA)

N76-27042# Battelle Pacific Northwest Labs., Richland, Wash.
SOME EXPERIMENTAL CONSIDERATIONS REGARDING ION BEAM SIMULATION OF NEUTRON IRRADIATION FOR MECHANICAL PROPERTY MEASUREMENTS
D. L. Styris, R. H. Jones, O. K. Harling, G. L. Kulcinski, and R. P. Marshall 1975 122 p refs
(Contract E(45-1)-1830)
(BNWL-1961) Avail: NTIS HC $5.50

A preliminary assessment of the requirements for mechanical property data related to reactor materials is given. The status of ion simulation for mechanical property measurements is described. A damage analysis and calculations for light ions are presented along with sample size, heating and cooling, and surface considerations. ERA

N76-27043# Argonne National Lab., Ill.
CONDITIONS OF VACUUM PHYSICS FOR SELECTION OF THE MATERIAL OF FIRST WALL AND DIAPHRAGM OF THE DEMONSTRATION THERMONUCLEAR REACTOR-TOKAMAK (T-20)
V. M. Gusev, M. I. Guseva, V. I. Gervids, V. I. Kogan, Yu. V. Martynenko, and S. V. Mirnov Jan. 1976 15 p refs Transl. into ENGLISH from Inst. Atomnoi Energii (USSR), no. IAE-2545, p 2-16 Sponsored by ERDA
(ANL-Trans-1031) Avail: NTIS HC $3.50

A model is given for plasma interaction with the wall and the introduction of contaminants. The model was characterized by two kinds of uncertainty. First, the uncertain behavior of the contaminants, and second, the uncertainty of boundary conditions. Some of the conclusions from the study are described. ERA

N76-27044# California Univ., Livermore. Lawrence Livermore Lab.
NEUTRAL BEAM INJECTION IN 2IIB
S. M. Hibbs 5 Nov. 1975 6 p refs Presented at IEEE 6th Symp. on Eng. Problems of Fusion Res., San Diego, Calif., 17 Nov. 1975 Sponsored by ERDA
(UCRL-77234; Conf-751125-26) Avail: NTIS HC $4.50

Integrated into the operation of the 2XIIB controlled fusion experiment is a 600-A, 20-keV neutral injection system: the highest neutral-beam current capacity of any existing fusion machine. The requirements of the injection system and the design features to which they led, are outlined. Both mechanical and electrical aspects are discussed. Also included is a brief description of some operational aspects of the system and some of the things learned along the way, as well as a short history of the most significant developments. Author (ERA)

N76-27045# Princeton Univ., N.J. Plasma Physics Lab.
TRANSIENT ANALYZER
M. D. Muir 1975 14 p Presented at the IEEE 6th Symp. on Eng. problems of Fusion Res., San Diego, Calif., 17 Nov. 1975 Sponsored by ERDA
(CONF-751125-120) Avail: NTIS HC $3.50

This sub-system was designed to be controlled through the data acquisition computer system which allows hands-off operation. Thus it may be placed on the experiment side of the high voltage safety break between the experimental device and the control room. This analyzer provides control features which are extremely useful for data acquisition from PPPL diagnostics. These include dynamic sample rate changing, which may be intermixed with multiple post trigger operations with variable length blocks using normal, peak to peak or integrate modes. Included in the discussion are general remarks on the advantages of adding intelligence to transient analyzers, a detailed description of the characteristics of the PPPL transient analyzer, a description of the hardware, firmware, control language and operation of the PPPL transient analyzer, and general remarks on future trends. Author (NSA)

N76-27046# Brookhaven National Lab., Upton, N.Y.
STEADY-STATE PLASMA AND REACTOR PARAMETERS FOR ELLIPTICAL CROSS SECTION TOKAMAKS WITH VERY LARGE POWER RATINGS
J. L. Usher and J. R. Powell Jun. 1975 91 p refs Sponsored by ERDA
(BNL-20759) Avail: NTIS HC $5.00

The purpose is to examine the effects of elliptical plasma cross sections. Several technological benefits were determined. Maximum magnetic field strength requirements are 30 to

65 percent less than for 5000 MW (th) reactors and may be as much as 40 percent less than for circular cross section reactors of comparable size. Very large n tau values are found, which produce large burn-up fractions (15 to 60 percent). There is relatively little problem with impurity build-up. Long confinement times (60 to 500 seconds) are found. The elliptical cross section reactors exhibit a major toroidal radius reduction of as large as 30 percent over circular reactors operating at comparable power levels. Author (NSA)

N76-27047# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
RELATIVE CONDUCTIVITY MEASUREMENTS ON A ROTATING PLASMA. A COMPARISON BETWEEN THEORY AND EXPERIMENT
D. Ohlsson Dec. 1975 47 p refs
(TRITA-EPP-75-29) Avail: NTIS HC $4.00

Relative measurements of electric conductivity were made on a rotating plasma confined by a poloidal magnetic field in an internal ring system. The technique used involves measuring the magnitude of low-frequency currents induced along the poloidal magnetic field lines. In order to make a comparison with theory, a nonstationary plasma fluid model was developed. The time and space dependent macroscopic fluid equations were solved using a numerical code. Reasonably good agreement between theory and experiment was found under the assumption of classical conductivity and a slowly varying effective charge number. Author (ESA)

N76-27048# European Space Agency, Paris (France).
THERMO-GASDYNAMICAL AND ELECTRICAL BEHAVIOR OF THE WALL AND VORTEX-STABILIZED ARC
August Wilhelm Neuberger Dec. 1975 119 p refs Transl. into ENGLISH of 'Thermogasdyn. u. elek. Verhalten des wand- u. drallstabilisierten Lichtbogens', DFVLR, Porz, West Ger. Report DLR-FB-75-38, 25 Apr. 1975 Original German report available from DFVLR, Cologne DM 46,20
(ESA-TT-220; DLR-FB-75-38) Avail: NTIS HC $5.50

The steady flow of a viscous and compressible plasma in local thermodynamic equilibrium was calculated with the help of a finite difference method. The plasma flowed in a tube with constant cross section. Energy was fed into the plasma by means of an electric arc, burning steadily and diffusely within the tube. The gas used was nitrogen. The main object was to investigate the influence of an azimuthal velocity component on the radial and axial distributions of pressure, enthalpy, density, velocity components, and electric field strength. The influence of the swirl on the energy balance and on the efficiency of the arc, with convective mass flow, is discussed. Author (ESA)

N76-27049# Rensselaer Polytechnic Inst., Troy, N.Y. Plasma Dynamics Lab.
CURRENT DENSITY AND SPACE POTENTIAL IN PLASMA Final Report, 1 Dec. 1974 - 30 Jun. 1975
Robert L. Hickok, William C. Jennings, and Kenneth A. Connor Sep. 1975 9 p refs
(Grant AF-AFOSR-2638-74; AF Proj. 9752)
(AD-A019793; RPDL-75-12; AFOSR-75-1643TR) Avail: NTIS CSCL 20/9

A model has been developed to assist in the design of a high current hollow cathode arc that will serve as a test bed for developing ion beam probe measurements of plasma current density. The theoretical analysis of plasma current density measurements has been extended to include non-cylindrically symmetric systems. Author (GRA)

N76-27050# Michigan Univ., Ann Arbor.
PLASMA SIMULATION USING STARAN Interim Report, 1 Jul. 1972 - 30 Sep. 1975
Griffiss AFB, N. Y. RADC Dec. 1975 48 p refs
(Contract F30602-73-C-0001; AF Proj. 5581)
(AD-A019301; RADC-TR-75-294) Avail: NTIS CSCL 20/8

The application of the associative processor STARAN to plasma Simulation problems is demonstrated. The algorithm tested is based on PIC (particle-in-cell) method discussed in the paper by Lewis, Sykes and Wesson. The program is written in the associative processor programming languages APPLE and MAPPLE. Author (GRA)

N76-27051# Office of Naval Research, London (England).
JET: THE JOINT EUROPEAN TORUS
Richard T. Schneider 15 Dec. 1975 20 p refs
(AD-A020464; ONRL-R-20-75) Avail: NTIS CSCL 20/8

This report is intended for technical people, whose expertise is not in the thermonuclear fusion area, but want to gain some insight into the present state of the art. After an introduction into the problems of fusion research and technology, the design, the goals and the operation schedule of JET (Joint European Torus) are described. Comparison to other Tokamak-type fusion devices is made. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N76-27052 Temple Univ., Philadelphia, Pa.
ELECTRONIC TRANSPORT PHENOMENA IN ORGANIC THIN FILMS Ph.D. Thesis
Dean Chung Wu 1976 162 p
Avail: Univ. Microfilms Order No. 76-12035

A brief introduction is given on observed switching and memery phenomena and voltage controlled negative resistance along with various proposed mechanisms for these anomalous behaviors in thin films. Experimental techniques and equipment used for vacuum deposition, temperature, electrical, thickness, thermal and optical measurements are described. Experimental results indicate that bistable switching in pure organic thin films is electrode-dependent. Memory switching in doped organic thin films is possibly explained by the formation of conducting filaments composed of charge-transfer complexes. The most interesting results are found in the codeposited tetracene-tetracyano-guinodimethan system. A mechanism is proposed to explain bistable switching in terms of phase change or crystallization in these organic thin films. Evidence in support of this proposed mechanism is given by differential scanning calorimetric data and polarized optical microscopic observation. Dissert. Abstr.

N76-27053 Adelphi Univ., Garden City, N.Y.
OBSERVATIONS OF MAGNETIC ANISOTROPY IN TYPE 2 SUPERCONDUCTORS Ph.D. Thesis
Richard James Hembach 1976 308 p
Avail: Univ. Microfilms Order No. 76-14034

An experimental study of the anisotropy of the magnetization vector M of type 2 superconductors was performed on two bulk monocrystalline samples of vanadium with varying degrees of purity (RRR = 87 and RRR = 27) at a temperature of 4.2K using a null deflection torque magnetometer. The orientation and field dependence of the angle phi between vector M and H sub O, and the applied magnetic field were determined and found to be fourfold symmetric with extrema at pi/8 with respect to a (100) symmetry axis. The results were consistent with the findings of Takanaka and Nagashima for a cubic material when H sub O lies in the (001) plane and H sub c2 - H sub O much less than H sub c2 with T approximately T sub c. For H sub O in the (001) plane the anisotropy or H sub c2 showed good correlation with that predicted by the nonlocal theory of Hohenberg and Werthamer, and in agreement with results reported by others. The pinned magnetization angle was observed to be fourfold symmetric only in the case of hard superconductor; no distinct orientation dependence of this angle was evident in the data for the purer sample. Dissert. Abstr.

N76-27054 Yale Univ., New Haven, Conn.
ORIENTATIONAL ORDER MEASUREMENTS IN THE NEMATIC AND SMECTIC PHASES OF LIQUID CRYSTALS Ph.D. Thesis
Terrence John McKee 1975 126 p
Avail: Univ. Microfilms Order No. 76-13212

The behavior of various order parameters characterizing molecular orientational order in nematic, smectic A and smectic C phases has been measured for selected compounds. Two NMR spectrometers for use in proton magnetic resonance and deuteron magnetic resonance were constructed for use in these

experiments. A proton NMR dipolar splitting proportional to the 'nematic order parameter' was measured in the nematic and smectic A phases of p-cyanobenzylidene-p-nonylaniline (CBNA) and p-cyanobenzylidene-p-octylaniline (CBOA) at pressure up to 3.5 kbar. A smectic A phase of CBOA was observed to become unstable relative to the solid phase at high pressures although the data for CBOA and CBNA were similar below 0.75 kbar. One order parameter measure is related to the degree of orientational order of the molecular long axis along the director while the other measures the difference in the degree of order of the transverse molecular axes along the director.
Dissert. Abstr.

N76-27055 Wisconsin Univ., Milwaukee.
A THEORY FOR ORDERED STATES APPLIED TO FERROMAGNETS AND SUPERCONDUCTORS Ph.D. Thesis
Manju Narendra Shah 1975 185 p
Avail: Univ. Microfilms Order No. 76-13768

The self-consistent method in quantum field theory is discussed. It is shown that this method is particularly suitable to the study of ordered states like the ferromagnetic and superconducting states. In both systems, the symmetry of the Heisenberg fields is rearranged, due to the dynamics of the system, to a different symmetry at the level of observation. For example, the spin rotation of electrons in a ferromagnet is induced by the E(2) symmetry transformation of quasielectrons and magnons. Dynamical rearrangement of symmetry in a ferromagnet is studied in detail using the path integral technique in field theory. The reason for rearrangement of symmetry is shown to be the infrared effect. This calculation is rigorous and holds for the itinerant electron ferromagnet and the localized spin model.
Dissert. Abstr.

N76-27056 Temple Univ., Philadelphia, Pa.
DETERMINATION OF THE ENERGY GAP IN A SUPERCONDUCTOR BY FLAT NIOBIUM 'POINT' CONTACT TUNNELING Ph.D. Thesis
Duck Hoon Lee 1976 137 p
Avail: Univ. Microfilms Order No. 76-12007

A flat niobium point contact tunneling technique is developed which minimizes the factors causing anomalous structures, namely the ac Josephson effect and the surface contamination on the niobium point. Thus an unambiguous determination of the energy gaps in superconductors forming the contact is possible.
Dissert. Abstr.

N76-27057 Pennsylvania Univ., Philadelphia.
SELF-CONSISTENT TREATMENT OF THE ANDERSON MODEL OF DILUTE MAGNETIC ALLOYS Ph.D. Thesis
Lawrence Sherman Baumann 1975 150 p
Avail: Univ. Microfilms Order No. 76-12245

Anderson model calculations based on the decoupling of Green function equations of motion were studied. It was found that when the equations of motion are decoupled at a certain point, the J predicted by the Schrieffer Wolff Transformation is obtained. Each Green function to be decoupled is expressed in terms of the corresponding cumulant Green function plus sums of products of lower order Green functions with equal time correlations. Then the cumulant Green function is set to zero. The equal time correlation functions are expressed in terms of lower order Green functions. A finite Coulomb interaction between impurity electrons, corresponding to the strong magnetic limit, is taken to simplify the analysis. The equations are reduced to a closed system of six nonlinear singular integral equations for six independent summations over Green functions. The resistivity, conduction electron magnetic susceptibility, and impurity electron magnetic susceptibility were determined over a temperature range approximately two decades above and below the Kondo temperature.
Dissert. Abstr.

N76-27058 North Texas State Univ., Denton.
TECHNIQUE FOR SEPARATION OF CARRIER DENSITIES AND MOBILITIES IN HIGHLY NONDEGENERATE MULTIBAND SEMICONDUCTORS Ph.D. Thesis
Lonnie Mack Rater 1975 120 p
Avail: Univ. Microfilms Order No. 76-12631

The development of the conductivity coefficients was reviewed for highly degenerate metals, having an energy dependent relaxation time, and semiconductors, obeying Boltzmann statistics and having a relaxation time varying as the energy to the lambda power. In each case the energy bands are assumed to be spherical and parabolic. These two developments allow for band parameters to be determined even in the absence of magnetic fields sufficiently large as to have saturation of the Hall constant. Before applying this theory, one must consider the nature of real semiconducting materials. They rarely have completely quadratic or spherical energy bands, and over many temperature ranges they do not have power-law dependent relaxation times. These real situations require much more complicated and time consuming calculations, so much that one is usually forced to use simplifications.
Dissert. Abstr.

N76-27059 Michigan State Univ., East Lansing.
METAMAGNETISM IN LOW DIMENSIONS Ph.D. Thesis
Paul R. Newman 1975 198 p
Avail: Univ. Microfilms Order No. 76-12499

Experimental investigations of low dimensional systems are presented. In the first instance measurements of: crystal lattice parameters, the space group, the susceptibility as a function of applied field, the bulk magnetization in applied field, as a function of temperature, NMR, and ESR are reported for manganese bromide trimethyl amine dihydrate. The exact crystal structure of the unit cell is at present unknown. But a partial crystal structure for manganese bromide trimethyl amine dihydrate is derived from the experimental evidence and shown to be related to a similar compound: cobalt chloride trimethyl amine. A second experimental investigation was concerned with the copper complex of the amino acid L-Isoleucine. Magnetic susceptibility in zero and applied field as well as ESR are reported. The orientation of the principal axes of the derived g-tensors are discussed in terms of the 4mm symmetry of the five fold local coordination of the 3d copper ion.
Dissert. Abstr.

N76-27060 Illinois Inst. of Tech., Chicago.
NONLINEAR ACOUSTOELECTRIC PHENOMENA IN SEMICONDUCTORS Ph.D. Thesis
Gautam Johri 1975 136 p
Avail: Univ. Microfilms Order No. 76-13161

The theory of parametric amplification, with particular reference to subharmonic and second harmonic generation, is developed in terms of the linear and nonlinear electrical conductivity tensors. By using the Boltzmann equation formalism with a constant relaxation time ansatz, the conductivity tensors for a material having parabolic band structure are evaluated: (1) in the absence of external dc fields and in presence of three collinear acoustic waves of frequencies omega sub1, omega sub2, and omega sub3 such that omega sub3 = omega sub1 + omega sub2 and (2) in the presence of a d.c. magnetic field transverse to the direction of propagation of the acoustic wave. The conductivity tensors are also evaluated in the presence of a dc electric field parallel to the direction of propagation of the acoustic wave by using the quantum Liouville equation formalism in the absence of collisions.
Dissert. Abstr.

N76-27061 Nebraska Univ., Lincoln.
TOTAL ATTENUATION COEFFICIENTS OF Cu, Cd AND Zn AT 14.41 keV MEASURED USING THE MOESSBAUER EFFECT Ph.D. Thesis
Louis James Caplan 1975 214 p
Avail: Univ. Microfilms Order No. 76-13320

The total attenuation coefficients of Cu, Cd and Zn were measured using the 14.41 keV Mossbauer transition of 26 Fe57. Because of the narrow width of the Mossbauer transition, the Mossbauer absorption spectrum represents a very high Q detection system allowing for the determination of the total attenuation coefficient without theoretical corrections to the data to account for scattering into the detector. A 10m Ci Co in Cu source and a 0.5 mg/sq cm SFC absorber were used. It was determined that SFC is an unresolved quadrupole doublet with a quadrupole splitting of less than 0.034 mm/sec and that deviations of the Mossbauer line shape from a Lorentz profile are noticeable for thin source and absorber if instrumental broadening is not present. The Mossbauer line shape was found to be well represented by a Voigt profile with results being comparable to those obtained using the transmission integral for the line shape. Dissert. Abstr.

N76-27062 Florida Univ., Gainesville.
EFFECTS OF A MAGNETIC FIELD ON NUCLEAR SPIN ORDERING IN SOLID He-3 Ph.D. Thesis
Raymond Bradfield Kummer 1975 116 p
Avail: Univ. Microfilms Order No. 76-12084

The effects of a magnetic field on nuclear spin ordering in solid 3He have been observed through the influence of the field on the solid entropy. By making use of the Clausius-Clapeyron equation the 3He melting temperature as a function of pressure was determined in several magnetic fields from 0 to 1.2 T from measurements of the latent heat of solidification in a Pomeranchuck cell. The solid entropy as a function of temperature was then calculated from the melting curve slope in each field by again utilizing the Clausius-Clapeyron equation. The solid ordering manifested itself as a substantial reduction in entropy occurring over a narrow temperature interval. A portion of the magnetic phase diagram of solid 3He was established by plotting the ordering temperature versus field. In low fields the reduction in entropy occurs over a very narrow temperature interval, and the ordering temperature is depressed by the field. Dissert. Abstr.

N76-27063 Michigan State Univ., East Lansing.
EFFECT OF INTERATOMIC INTERACTIONS ON THE ZERO-BANDWIDTH HUBBARD HAMILTONIAN, A. THEORY OF SUPEREXCHANGE INTERACTIONS IN MAGNETIC INSULATORS, B Ph.D. Thesis
Rem Sing Tu 1975 90 p
Avail: Univ. Microfilms Order No. 76-12536

The linear-chain zero-bandwidth Hubbard Hamiltonian with added nearest-neighbor interaction, with a magnetic field present is considered. By the transfer matrix method, exact expressions for thermodynamic quantities are obtained in simple closed form for the half-filled band. Recently, the half-filled band Hubbard model for the linear chain was proposed to explain the properties of the organic salt NMP-TCNQ. It was shown that the susceptibility chi versus temperature T obtained from the Hubbard model disagreed in an essential way with the experiment. The experimental susceptibility rapidly becomes too small with increasing T, showing in particular what appears as a Curie-Weiss law with a moment appreciably reduced from the theoretical value. Also, Anderson's theory of superexchange was studied. It is thought that the exchange interaction between magnetic ions in a magnetic insulator is described essentially by the Heisenberg Hamiltonian; also the exchange parameter J is of 4th order in the overlap between para-and dia-magnetic ions. However, the Wannier functions are not uniquely defined in the superexchange problem. Dissert. Abstr.

N76-27064 Washington Univ., Seattle.
ADRF STUDIES OF ULTRA SLOW DIFFUSION IN SOLID NEON Ph.D. Thesis
Bruce Elliott Sirovich 1975 124 p
Avail: Univ. Microfilms Order No. 76-14087

Diffusional motions of neon in the very cold crystalline fcc lattice at temperatures below 25 K were studied. The region of interest for the study was the range of diffusional lattice jumps from once every tenth of a second to the limiting case of one jump every thousand seconds. The technique employed was a refinement of that used by earlier investigators in ADRF studies in other solids; it consists of subjecting a population of spins ordered along a laboratory magnetic field to a conventional 90 deg nutating pulse then, instead of permitting a free induction decay to ensue, the RF at the resonant frequency in phase shifted to achieve a spin lock and adiabatically reduced to zero. The current work, when taken together with other motional studies in rare gas solids, can provide a powerful insight into fundamental atomic motions in a well-ordered crystal, and this information can be applied to the motion of impurities in solid state devices, and to the translational movement of flaws and contamination in vessels employed for storing radioactive substances.
Dissert. Abstr.

N76-27065 California Inst. of Tech., Pasadena.
DAMPED FREE OSCILLATION OF MAGNETIZATION IN Ni-Fe THIN FILMS Ph.D. Thesis
Yoshitaka Suezawa 1976 126 p
Avail: Univ. Microfilms Order No. 76-14250

Damped free oscillations of the magnetization have been clearly observed at the completion of 180 deg flux reversal along both the easy and the hard axis in Ni-Fe thin films. The flux component perpendicular to the applied pulse field was observed using a single turn pickup loop around the film. The frequency of the oscillation was studied as a function of applied pulse field and compared with the results obtained by ferromagnetic resonance. The frequency of the damped free oscillation agreed quite well with that obtained by resonance when the frequency was measured after the oscillation had damped to small amplitude. The damping constant obtained from the decay of the oscillation agreed quite well with that obtained from the halfpower line-width of the resonance curve. Dissert. Abstr.

N76-27066 Pennsylvania Univ., Philadelphia.
CHARACTERISTICS OF VERY SMALL JOSEPHSON TUNNEL JUNCTIONS Ph.D. Thesis
James Tien-Cheng Yeh 1975 228 p
Avail: Univ. Microfilms Order No. 76-12368

A detailed experimental study of very small Josephson tunnel junctions is presented. A greater understanding was obtained of how a small junction behaves and how one can operate it for various applications. A small Josephson tunnel junction is one with an area less than about 1,000 square microns. It has a comparatively large normal-state resistance and hence a small dc critical current. The former yields high junction impedance which matches better with that of free space, promising a junction useful as a microwave detector. The latter, however, yields small Josephson coupling energy which may not be large compared to either the thermal or noise energies. A new fabrication method for very small junctions and microbridges is described in much detail. The junction dimension is controlled by a SiO channel which is prepared by evaporation through a mask of very thin glass fiber of 1 micron diameter. The resulting tunnel junctions are planar, rectangular in shape, and have the in-line geometry. Dissert. Abstr.

N76-27067 Wisconsin Univ., Milwaukee.
ELECTRON-PHONON INTERACTION IN SUPERCONDUCTING VANADIUM Ph.D. Thesis
Joseph Anthony Waynert 1975 136 p
Avail: Univ. Microfilms Order No. 76-13770

Electron-phonon interaction in superconducting vanadium was measured through the determination of the ultrasonic attenuation coefficient. Measurements were made as a function of temperature and magnetic field in three single crystal vanadium samples with resistivity ratios of 7.8, 245, and 450, to be referred to as samples 1, 2, and 3, respectively. Transverse waves were used with the phonon wave vector, parallel to the applied magnetic field. The direction of propagation was (110), (110), and (100), for a frequency of 255 MHz, 15 MHz, and 45 MHz, in samples 1, 2, and 3, respectively. Longitudinal waves were also used in sample 1. The predicted temperature and field dependence, in all cases, agree extremely well with the experimental results. The values obtained for the electron mean free path were compared to the values obtained from dc conductivity measurements and from free electron model predictions for attenuation versus frequency. The zero temperature BCS energy gap was also found for each sample. Dissert. Abstr.

N76-27068 Clemson Univ., S.C.
THE EFFECT OF LARGE UNIAXIAL STRESS ON THE SUPERCONDUCTING TRANSITION TEMPERATURE OF ZINC AND CADMIUM Ph.D. Thesis
Charles Lee Watlington 1975 55 p
Avail: Univ. Microfilms Order No. 76-12964

The effect of large uniaxial stresses on the superconducting transition temperature Tc for pure zinc and cadmium was measured using whiskers in various crystalline directions for these metals. It was found that the initial slope of the change in Tc with respect to the stress was a linear function of the square of the cosine of theta (the angle between the crystal hexagonal axis and the long axis of the sample) for cadmium but not for zinc. The following values of this slope were given: 3.7 and -0.46 respectively for the cadmium direction parallel and perpendicular to the hexagonal axis, and 5.1 and -1.0 respectively for zinc, all in units of 10 to the -10 power times K sq m/N. The following values of the change in Tc with respect to the pressure were also given: 3.1 for zinc and 2.8 for cadmium. Dissert. Abstr.

N76-27069 Pennsylvania Univ., Philadelphia.
THREE DIMENSIONAL SURFACE EFFECTS IN FIELD EMISSION Ph.D. Thesis
Richard Alan Woldin 1975 136 p
Avail: Univ. Microfilms Order No. 76-12364

Electron field emission from a semi-infinite crystal terminated by a three dimensional corrugated surface is theoretically analyzed. The surface potential employed is an additive cosine function so defined as to include the various properties associated with a real physical surface while still being amenable to mathematical manipulation. Expressions for tunneling probability and current emission, as well as the three dimensional wave functions necessary for their evaluation are developed. Surface periodicity effects, shown to manifest themselves through Mathieu equations, produce non spherical constant energy surfaces in K-space. For numerical calculation the physical properties for tungsten were used. The analysis showed that although emitted current is similar for planar and corrugated surfaces, in the latter case, tunneling probability is vectorially dependent on the transverse k-vector.
Dissert. Abstr.

N76-27070 North Texas State Univ., Denton.
INVESTIGATION OF THE EFFECTS OF COMPRESSIVE UNIAXIAL STRESS ON THE HOLE CARRIERS IN P-TYPE INSB Ph.D. Thesis
Bobby Jack Vaughn 1975 125 p
Avail: Univ. Microfilms Order No. 76-12633

The influence of uniaxial compression upon the Hall effect and resistivity of cadmium-doped samples of InSb at 77 K, 64 K and 12 K are reported. Uniaxial compressions as high as 6 kbar were applied to samples. The net hole concentration of the samples were about 5 times ten to the thirteenth per cu. cm. at 77 K as determined from the Hall coefficient at 24 kilogauss. Neither the Hall mobility nor the piezoresistance became independent of the magnitude of the applied stress. The Hall mobility shows a smooth rise with stress, and the piezoresistance decreases monotonically with increasing compression. The magnetic-field dependence of the Hall coefficient is strongly dependent upon the magnitude of the applied stress for magnetic fields between 50 gauss and 24 kilogauss. Results show that the net concentration of hole carriers decreases and then increases exponentially with stress at 77 K and 64 K, while at 12 K there is only a monotonic increase of carrier concentration with stress.
Dissert. Abstr.

N76-27071 Northwestern Univ., Evanston, Ill.
A STUDY OF ELECTROMIGRATION IN THIN GOLD FILMS Ph.D. Thesis
William Lee Harrod 1975 111 p
Avail: Univ. Microfilms Order No. 76-13103

Electromigration at high current densities and low temperatures was studied in thin gold films. The test specimens consisted of gold conductor films ranging in thickness from 1000 to 2000 A, which were deposited on substrates with predefined contact pads of titanium and gold (1000 A Ti, 5000 A Au). The gold conductor films were deposited directly on the substrate layer by vacuum evaporation. The goal of the experimental work was to establish a complementary set of measurements and analysis methods which would allow evaluation of the relative effects on electromigration of temperature, temperature gradients, current density, and specimen geometry. A variety of analysis techniques were used to characterize the films during and after current stressing. The experimental work resulted in a comprehensive characterization of the electromigration behavior of thin, pure gold conductor films. Conclusions relative to the following properties were given: activation energy, subsurface voids, ion migration, lifetimes.
Dissert. Abstr.

N76-27072*# Scientific Translation Service, Santa Barbara, Calif.
STUDY OF PARTIAL DISCHARGES IN SOLID DIELECTRICS
F. Torelli Washington NASA Jun. 1976 22 p refs Transl. into ENGLISH from Elettrotecnia (Italy), v. 57, no. 5, May 1970 p 289-294
(Contract NASw-2791)
(NASA-TT-F-15479) Avail: NTIS HC $3.50 CSCL 20L

The mechanism of partial discharges in gaseous inclusions which are found unavoidably in solid dielectrics was examined. The parameters which characterize the danger related to the decay of insulating materials are identified.
Author

N76-27073# Lockheed Missiles and Space Co., Palo Alto, Calif.
RUPTURE OF KDP CRYSTALS BY ULTRASHORT LASER PULSES
V. A. Gridin, V. A. Krotov, and A. N. Petrovskii [1976] 6 p refs Transl. into ENGLISH from Kvantovaia Elektron. (USSR), v. 3, no. 2, 1976 p 311-315
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

The effect of ultrashort laser pulses on nonlinear LiNbO3 crystals was investigated. It is shown that crystal rupture is discrete in nature, independent of their orientation and the lens focal length. The rupture threshold energy increases with the increase in the lens focal length. By using the method of two frame pulse holography it is shown that rupture grows on both sides of the focal plane and the rate of rupture development towards the laser pulse is estimated to be 1.6 x 10 to the 10th power cm/sec.
Author

N76-27074# Lockheed Missiles and Space Co., Palo Alto, Calif.
SINGULARITIES OF NONRESONANT EXCITATION OF SUPERRADIATION AND PHOTON ECHO SIGNALS
S. O. Eliutin [1976] 5 p refs Transl. into ENGLISH from Kvantov. Elektron. (USSR), v. 3, no. 3, 1976 p 357-361
Avail: NTIS HC $3.50; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Superradiation and light echo phenomena are examined theoretically under conditions when the frequency of the exciting radiation does not agree with the central frequency of an inhomogeneously broadened line. It is detected that distortion of the superradiation signal contour under non-resonant excitation depends substantially on the spectrum width of the exciting pulses.
Author

N76-27075# Argonne National Lab., Ill.
MEASURED AND EVALUATED FAST NEUTRON CROSS SECTIONS OF ELEMENTAL NICKEL
P. Guenther, A. Smith, D. Smith, J. Whalen, and R. Howerton (California Univ., Livermore, Lawrence Livermore Lab.) Jul. 1975 159 p refs
(Contract W-31-109-eng-38)
(ANL/NDM-11) Avail: NTIS HC $11.00

Fast neutron total and scattering cross sections of elemental nickel are measured. Differential elastic scattering cross sections are determined from incident energies of 0.3 to 4.0 MeV. The cross sections for the inelastic neutron excitation of states at: 1.156 + or - 0.015, 1.324 + or - 0.015, 1.443 + or - 0.015, 2.136 + or - 0.013, 2.255 + or - 0.030, 2.449 + or - 0.030, 2.614 + or - 0.020 and 2.791 + or - 0.025 MeV are measured to incident neutron energies of 4.0 MeV. The total neutron cross sections are determined from 0.25 to 5.0 MeV. The experimental results are discussed in the context of optical and statistical models. It is shown that resonance width fluctuation and correlation effects are significant. The present experimental and theoretical results, together with previously reported values, are used to construct a comprehensive evaluated elemental data file in the ENDF format.
Author (ERA)

N76-27076# Argonne National Lab., Ill.
MOESSBAUER RELAXATION LINESHAPES IN THE PRESENCE OF HYPERFINE INTERACTIONS CONTAINING OFF-DIAGONAL TERMS
G. K. Shenoy and B. D. Dunlap Aug. 1975 12 p refs Presented at the Intern. Conf. on Mossbauer Spectroscopy, Cracow, Poland
(Contract W-31-109-eng-38)
(CONF-750815-1) Avail: NTIS HC $4.50

The presence of off-diagonal terms makes the task of obtaining closed-form lineshape expressions difficult. The superoperator formulation of the relaxation problem is considered. The master equation obtained is considerably simplified because the energy enters only along the diagonal as a constant. Then the slave equation is used to obtain the lineshape over energy in a simple algebraic way. The calculation of spectral lineshapes in the presence of relaxation (spin, charge, or EFG - electric field gradient)

is rather straightforward using this formulation. Examples are taken from studies of heme compounds. ERA

N76-27077# Northwestern Univ., Evanston, Ill. Dept. of Materials Science and Engineering.
EFFECT OF POINT DEFECTS ON MECHANICAL PROPERTIES OF METALS Progress Report, 1 Jan. - 31 Dec. 1975
M. Meshii Dec. 1975 12 p refs
(Contract AT(11-1)-1367)
(COO-1367-73) Avail: NTIS HC $3.50

Results of research activities are presented on electron irradiation softening in pure Fe, effects of impurities on electron irradiation softening, electron microscopic investigation of electron irradiation softening, surface film softening, and dislocation motion. ERA

N76-27078# California Univ., Berkeley. Lawrence Berkeley Lab.
THERMODYNAMIC AND KINETIC STUDIES OF SOME GROUP 3 AND GROUP 5 ELEMENTS AND ALLOYS BY SOLID STATE ELECTROCHEMICAL TECHNIQUES M.S. Thesis
T. J. Anderson Oct. 1975 182 p refs
(Contract W-7405-eng-48)
(LBL-4148) Avail: NTIS HC $7.50

The Gibbs free energy of forming gallium sesquioxide and indium sesquioxide are measured using a CO2-CO-O2-gas reference electrode and calcia stabilized zirconia as the solid electrolyte. The free energies are: DELTA G/sub f/(beta-Ga2O3(c)) equals -(265,209 +- 152) + (82.47 +-0.16) (T/K) cal/mol and DELTA G/sub f/(In2O3(c)) equals -(223,160 +- 137) + (79.47 +- 0.12) (T/K) cal/mol. Measured absolute free energies of formation of In2O3 and beta-Ga2O3 are in excellent agreement with previous studies though discrepancies are found in the standard entropy and enthalpy changes. Comparison is made to available calorimetric results by a third law calculation with the data of this investigation proving to be the most consistent. A solid state galvanic cell is employed to measure gallium activities in Ga-Sb liquid alloys. A survey of the available literature indicates gallium activities ranging from moderate positive to strong negative deviations from Raoult's law. Author (NSA)

N76-27079# United Kingdom Atomic Energy Authority, Harwell (England).
GROUP THEORY AND ITS APPLICATIONS TO MOLECULES AND DEFECTS IN SOLIDS
A. E. Hughes Apr. 1975 110 p refs
(AERE-R-8024) Avail: ERDA Depository Libraries HC $6.00

The application of the theory of crystal point groups to the properties of molecules and defects in solids is described. The first part of the text discusses the formal group theory required as a basis for applications in this field. It covers the basics of elementary group theory, the theory of representations, the properties of the thirty two point groups and the incorporation of electron spin in the group formalism. The second part discusses application of the theory to the physical properties of crystals, crystal field theory, molecular orbitals, ligand field theory, vibrations and perturbation experiments (e.g. uniaxial stress and Zeeman effects). The use of irreducible tensor operators and time reversal symmetry are also discussed. Author (ERA)

N76-27080# Sandia Labs., Albuquerque, N.Mex.
ANALYSIS OF TARGETS WITH NONUNIFORM COMPOSITION AS A FUNCTION OF DEPTH: ELASTIC AND INELASTIC SCATTERING
R. A. Langley Dec. 1975 33 p refs
(Contract AT(29-1)-789)
(SAND-75-0331) Avail: NTIS HC $4.00

An analytical technique to reduce yield versus energy spectra to impurity concentration versus depth is described. It applies to both elastic and inelastic reactions and calculates the depth distribution profile directly from the observed data. It uses the experimental spectrum to be analyzed, stopping cross sections and reaction cross sections to obtain the desired depth scales and the depth dependence of the target composition. A computer code, NUCREA, has been developed to perform such analysis. A description of NUCREA, a user's guide, a complete listing and a typical output for the code are contained in the report. An example showing the analysis of experimental data is also presented. NSA

N76-27081# Brookhaven National Lab., Upton, N.Y.
FINITE-AMPLITUDE WAVES IN A SUPERCONDUCTING COAXIAL LINE
M. I. Kiselev 1975 9 p refs Transl. into ENGLISH from Zh. Tekh. Fiz. (USSR), v. 45, no. 2, 1975 p 382-385 Sponsored by ERDA
(BNL-tr-614) Avail: NTIS HC $4.50

The propagation of deformations and perturbations of the magnetic field in a superconducting transmission line consisting of a coaxial system of elastic conductors cooled by streams of cryogenic liquid is treated in the hydrodynamic approximation. Author (NSA)

N76-27082# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
SUPERCONDUCTIVITY IN TIGHT-BINDING APPROXIMATION
S. J. Poon Oct. 1975 12 p refs
(Contract AT(04-3)-822)
(CALT-822-77) Avail: NTIS HC $3.50

An interpretation of Barisic's relation for transition elements between the D-electron contribution to the cohesive energy and the local atomic parameter eta is presented. This relation is extended to a lattice with more than one atom per unit cell in the tight-binding approximation of rigid ions. It is conjectured that Barisic's relation is correct to first order approximation for transition metal alloys, provided the phonon induced d-d coupling is the dominant mechanism for superconductivity. Author (NSA)

N76-27083# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
STUDY OF A PHOSPHORUS PLANAR DIFFUSION SOURCE M.S. Thesis
Richard B. Rippere Dec. 1975 83 p refs
(AD-A019857; GE/EE/75-38) Avail: NTIS CSCL 20/12

A phosphorus planar diffusion source (PDS) is a ceramic-like material in wafer form which is placed in the diffusion furnace with the silicon wafers. Each PDS wafer can be used to dope one or two silicon wafers, providing phosphorus atoms which diffuse into the silicon. The main objective of the thesis has been to obtain experimental data on the sourcing characteristics of the phosphorus PDS in preparation for their use in the manufacture of devices. The parameters which characterize the sourcing ability of a material, and which were therefore studied are the time, temperature, ambient gas, and ambient gas flow rates. The spacing and position of the PDS in relation to the silicon wafers are parameters unique to the PDS and were also investigated. GRA

N76-27084# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DEPTH RESOLVED CATHODOLUMINESCENCE OF CADMIUM IMPLANTED GALLIUM ARSENIDE M.S. Thesis
Dan L. Boulet, Jr. Dec. 1975 76 p refs
(AD-A019950; GEP/PH/75D-15) Avail: NTIS CSCL 20/12

Three samples of GaAs were examined by depth resolved cathodoluminescence using electron beam energies from 5 KV to 25 KV at 10K and 80K. Samples 1 and 2 had been Cd implanted at 135 KV and annealed at 800C for 10 minutes; they received doses of 10 to the 15th power ion/sq cm and 10 to the 14th power ion/sq cm respectively. Sample 3 was n-type epitaxial and had not been intentionally doped. In the Cd implanted samples, the peak normally located near 1.488 eV at 10K (1.481 eV at 80K) was observed to shift to lower energy as the beam energy was reduced. This shift was interpreted as being caused by a depth dependent Cd concentration which was higher near the surface. Peak shifts as were observed in Samples 1 and 2 did not occur in the depth resolved spectra of Sample 3. From this study, it was concluded that using depth resolved cathodoluminescence spectra, energy shifts of peaks resulting from simple center recombinations can, under certain conditions, be used to estimate the extent of an implanted impurity concentration. GRA

N76-27085# State Univ. of New York, Stony Brook. Dept. of Earth and Space Sciences.
ORIGIN OF PLASTIC DEFORMATION IN OLIVINE AND PYROXENE Final Report, 15 Jul. 1972 - 30 Jun. 1975
Smith Morrison, Neville Carter, and Charles Prewitt 1 Sep. 1975 23 p refs
(Contract F19628-73-C-0037; AF Proj. 8607)
(AD-A020040; AFCRL-TR-75-0505) Avail: NTIS CSCL 20/2

Experimentally and naturally deformed olivines, orthopyroxenes and amphiboles have been investigated by transmission electron microscopy to determine the dislocation substructure. Several sets of substructures have been determined and these have been combined with high temperature determinations of the crystal structure in an attempt to explain variations in operative slip system with temperature. This goal has been achieved only partially; a theoretical model was devised to account for twin-gliding in amphiboles, and initial work was done in attempting to model the enstatite-clinoenstatite transformation from an energetical point of view. The nature of exsolution lamellae in orthopyroxenes and amphiboles was also examined by TEM means. Author (GRA)

N76-27086# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ANALYSIS OF SEMICONDUCTOR STRUCTURES BY NUCLEAR AND ELECTRICAL TECHNIQUES Interim Report
Sylvanus S. Lau, James W. Mayer, Kunio Nakamura, Marc A. Nicolet, and B. Manfred Ullrich 15 Oct. 1975 46 p refs
(Contract F19628-75-C-0008; AF Proj. 5638)
(AD-A019638; AFCRL-TR-75-0550; SR-2) Avail: NTIS CSCL 20/12

This report presents three studies of thin film reactions between metal films and Si. In these studies MeV He ion backscattering spectrometry, Auger electron spectroscopy, secondary electron microscopy and glancing angle X-ray diffraction are used as the principal tools of analysis. (1) At temperatures well below the Si-Al eutectic (577C), fine grained polycrystalline Si in contact with Al films recrystallizes in the Al matrix. The recrystallization can be deferred or suppressed by placing a buffer layer of V or Ti between the Al film and poly Si. (2) When annealing Pt films deposited on Si in an O2 ambient the formation of PtSi does not consume all the Pt. The top layer of Pt is separated from the underlying PtSi by a thin SiO2 layer. (3) The formation of Ni silicide depends on the structural characteristics of the Si substrate. The growth of the silicide (Ni2Si) initially formed is faster on /100/ and poly Si than on /111/ Si. For Ni on amorphous Si, NiSi also appears. GRA

N76-27087# Illinois Univ., Urbana. Coordinated Science Lab.
STRUCTURE AND ELECTRICAL PROPERTIES OF rf SPUTTER DEPOSITED INDIUM ANTIMONIDE THIN FILMS M.S. Thesis
Charles Edward Wickersham, Jr. Dec. 1975 70 p refs
(Contract DAAB07-72-C-0259)
(AD-A019575; R-705; UILU-ENG-75-2241) Avail: NTIS CSCL 20/12

During the last few years, sputtering has become a very important industrial technique for depositing thin films. Typical applications include metalization and passivation in the electronics industry, the deposition of complex cermets, glasses, and plastics, and the formation of coatings for corrosion, abrasion, and wear resistance. However, relatively little work has been reported on the growth of compound semiconducting films by sputtering. Author (GRA)

N76-27088# Northwestern Univ., Evanston, Ill.
ELECTRONIC STRUCTURE AND TRANSPORT PROPERTIES OF INTERMETALLICS Final Report
Arthur J. Freeman, Donald E. Ellis, and Lawrence B. Welsh Dec. 1975 23 p refs
(Grant AF-AFOSR-2012-71; AF Proj. 9764)
(AD-A019684; AFOSR-75-1661TR) Avail: NTIS CSCL 20/12

The electronic interactions responsible for the unusual properties of several important classes of materials (including the highly anisotropic layered dichalcogenides, and network and cage structure materials and pseudobinary alloys) have been investigated experimentally and theoretically. The unique ability of NMR to probe the local electronic properties of the various constituents of an intermetallic compound or alloy has provided important new information including correlations with observed changes in superconducting transition temperatures. Novel theoretical models (including relativistic effects) are found to yield energy band structures, Fermi surfaces, transport properties, charge and spin densities, generalized magnetic susceptibilities, and optical properties in very good agreement with experimental determinations of these observable phenomena. Author (GRA)

N76-27089# Northwestern Univ., Evanston, Ill. Dept. of Physics.
NEGATIVE MICROWAVE RESISTANCE EFFECT IN ZERO-GAP SEMICONDUCTORS Final Report, 15 Jun. 1974 - 31 Aug. 1975
L. Liu 1975 4 p refs
(Grant AF-AFOSR-2731-74; AF Proj. 9763)
(AD-A019557; AFOSR-75-1632TR) Avail: NTIS CSCL 20/12

The band structure of alpha-tin and HgTe under uniaxial tensile stress has been investigated. Both zero and finite-temperature transport calculations were performed. While zero-temperature calculations indicated the negative differential resistivity (NDR) effect exists under stress, the finite temperature calculations indicated that it would be difficult to obtain NDR at room temperature unless the effect could be enhanced by scattering or band coupling not included in the calculation. Author (GRA)

N76-27090# Colorado Univ., Boulder.
LASER SPECTROSCOPY OF WIDE BANDGAP SEMICONDUCTORS Final Report, 1 Mar. - 31 Aug. 1975
James F. Scott 31 Aug. 1975 19 p refs
(Contract AF-AFOSR-2835-75; AF Proj. 9763)
(AD-A019791; AFOSR-75-1591TR) Avail: NTIS CSCL 20/12

This report presents a definitive determination of the valence band structure of ZnTe. It also shows the utility of spontaneous spin-flip scattering of laser light for such determinations where EPR fails. Author (GRA)

N76-27091# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH Quarterly Technical Summary Report, 1 May - 31 Jul. 1975
Alan L. McWhorter 15 Aug. 1975 61 p refs
(Contract F19628-76-C-0002; AF Proj. 649L)
(AD-A019472; TN-1975-3; ESD-TR-75-249) Avail: NTIS CSCL 20/12

This report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 May through 31 July 1975. The topics covered are Solid State Research, Quantum electronics, materials research, and Microelectronics. The Microsound work is sponsored by BMDATC and is reported under that program. Author

N76-27092# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanics and Materials Science.
A PRESSURE CALIBRATION FOR THE DIAMOND-ANVIL CELL IN THE RANGE 0-15k BARS
B. A. Newman, T. P. Sham, and K. D. Pae 31 Dec. 1975 12 p refs
(Contract N00014-67-A-0115-0007; NR Proj. 356-564)
(AD-A019652; TR-3) Avail: NTIS CSCL 07/4

An X-ray pressure-standard suitable for use with the diamond-anvil cell, at pressures up to 15K bars, has been developed. A pressure-volume relationship was assumed for hexamethylenetetramine (H.M.T.), and a least squares program was used to fit the equation to experimental data obtained at 298K. Using this relation a table of interplanar spacings of the (110) planes at different pressures was constructed. The derived equation is discussed in terms of the volume compressibility, and the Gruneisen constant for H.M.T. GRA

N76-27093# Frankford Arsenal, Philadelphia, Pa.
ELECTRICAL PROPERTIES OF As2S3 GLASS
Lloyd C. Bobb, Harold H. Byer, and Kimball Kramer Mar. 1975 36 p refs
(DA Proj. 1T1-61102-A-31C)
(AD-A020552) Avail: NTIS CSCL 20/12

Aluminized platelets of As2S3 glass were poled at tempera-

tures as high as 220C and with electric fields up to 16 kV/cm. Electrical measurements on these samples yield the following results: (a) aluminum forms an ohmic contact with the glass, (b) the resistivity rho about 10 to the 11th power ohm-cm, (c) the dielectric constant epsilon about 11, (d) the electrical band gap is 2.40 eV as compared to 2.40 eV for the optical band gap, (e) the depolarization current generated by the samples is not of pyroelectric origin, (f) the polarization charge on the sample is as high as 4 microcoulombs/sq cm, (g) the depolarization current is described by more than one relaxation time, (h) the data fit a trapped charge model better than a dipolar model, (i) the trap levels measured in these experiments are in the range 1.0 to 1.4 eV, and (j) on the basis of these experiments there is no evidence of pyroelectricity in these samples. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N76-27094 Pennsylvania Univ., Philadelphia.
THERMODYNAMIC STUDIES OF ADSORPTION FROM VAPOR AND LIQUID MIXTURES ON SOLIDS Ph.D. Thesis
Charles Joseph Minka 1975 173 p
Avail: Univ. Microfilms Order No. 76-12311

Vapor-solid and liquid-solid interfaces are described in terms of solution thermodynamics. Experimental data are reported for adsorption from vapor and liquid mixtures. A study is made of the variation of surface activity coefficients of benzene and cyclohexane vapors adsorbed on two types of adsorbents (nonporous graphitized carbon and microporous activated charcoal). The adsorbed phases on both of these adsorbents are, within experimental error, ideal up to a reduced pressure of about 0.75. The mixture is moderately nonideal in the bulk liquid phase. A new procedure proposed for calculating surface activity coefficients at high coverage on microporous adsorbents is used in the analysis of the data for adsorption on activated charcoal. The variation with coverage of other properties of the adsorbed phase, such as its composition, is also studied. The adsorption equilibria of the binary vapor mixture is determined gravimetrically. Dissert. Abstr.

N76-27095 Miami Univ., Fla.
HIGH PRESSURE P-V-T PROPERTIES OF SEAWATER AND RELATED LIQUIDS Ph.D. Thesis
Rana Arnold Fine 1975 222 p
Avail: Univ. Microfilms Order No. 76-12842

An equation of state was developed from velocity of sound data for seawater, pure water, and deuterium oxide (D2O) P V sup 0/V sup 0 - V = B + A sub 1 P + A sub 2 P sup 2 where V sup 0 and V are, respectively, the specific volume at one atmosphere and pressure P, and B, A sub 1, and A sub 2 are functions of temperature and concentration. The equation of state from the seawater velocity of sound data and GEOSECS station data for five Atlantic stations were combined to examine the effects of the nonlinearity of the P-V-T properties. This was done using equations to calculate the change in the potential energy after an adiabatic interchange followed by mixing. The possible importance of the nonlinearity of the P-V-T properties was found in the region of the pycnocline at three of the stations. Dissert. Abstr.

N76-27096 Iowa Univ., Iowa City.
COMBINED RADIATION-CONVECTION FOR A REAL GAS Ph.D. Thesis
Naresh Kumar Nakra 1975 107 p
Avail: Univ. Microfilms Order No. 76-13426

A study of interaction of radiative transfer with convective transfer is presented for a gas flowing in a tube with specified isothermal black walls. The gas traverses the tube at a specified uniform mass flow rate, uniform axial velocity distribution and a uniform temperature at each cross section. Five parameters govern the energy equation and specification of these parameters determines the gas temperature distribution and wall heat flux values. These are: the Boltzmann number, the Stanton number, inlet gas temperature, wall temperature and length to diameter ratio. Results for several values of these parameters are presented and the effects of cooling and heating of the gas are also studied. The inclusion of radiative transfer with convective transfer profoundly affects the axial gas temperature distribution. Pure convection results and those for a stagnant radiative gas yield two outer limits and all other results for pure radiation and for combined radiation and convection are bracketed by these two combined limits. Dissert. Abstr.

N76-27097 Stanford Univ., Calif.
ENERGY AND ENTROPY CONTRIBUTIONS TO THE THERMODYNAMIC PROPERTIES OF LIQUID METALS Ph.D. Thesis
Cheng-Liang Lu 1976 162 p
Avail: Univ. Microfilms Order No. 76-13035

The PVT properties of liquid sodium, potassium, rubidium and gallium were determined using a piezometric apparatus for a temperature range from their normal melting points to 200 C and at pressures up to 8,000 bars. The specific volumes were measured with sufficient precision so that the first and second volume derivatives could be computed with reasonable accuracy. These data were then used to obtain, according to thermodynamic relations, the individual energy and entropy contributions to the pressure and the bulk modulus. Similar quantities were also obtained for mercury from literature data. It was seen that the bulk modulus for alkali metals is primarily due to the entropy contribution and the energy term is only a small fraction of the former. Calculations were made for the pressure, bulk modulus and thermal pressure coefficient of these five liquid metals using the pseudopotential theory of simple metals. Dissert. Abstr.

N76-27098# General Electric Co., Lynn, Mass. Industrial and Marine Steam Turbine Operation.
HIGH PERFORMANCE REHEAT MARINE STEAM PROPULSION PLANT, PHASE 1 Final Report
30 Jan. 1976 101 p
(Contract MA-5-38068)
(PB-249364/1; MA-RD-920-76033) Avail: NTIS HC $5.50 CSCL 21E

This report discusses heat balances for full power and 70 percent power which will be compared to balances to be done in Phase 2 to evaluate gains due to thermodynamic cycle changes. Available information was assembled on high temperature materials. Parametric studies were made of stresses in wheels and buckets taking into account centrifugal effects and steam forces. Preliminary studies were made on machinery arrangements of HP and IP turbine(s). Calculations were made of thermal performance to determine influence of number of stages, diameter, rotational speed, etc. on the design of HP and IP turbines. Auxiliary turbine designs were roughed out. GRA

N76-27099# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
CALCULATED VIBRATION-ROTATION INTENSITIES AND LINE POSITIONS FOR GROUND STATE NITRIC OXIDE Physical Sciences Research Papers
Frank P. Billingsley, II 13 Nov. 1975 181 p refs
(AF Proj. 7670)
(AD-A019790; AFCRL-PSRP-651; AFCRL-TR-75-0586) Avail: NTIS CSCL 20/10

A group of tables is presented listing accurate theoretical line positions and absolute emission intensities for individual multiplet-vibration-rotation transitions in the ground state of nitric oxide. The data covers both intramultiplet and intermultiplet (satellite band) transitions for vibrational levels up to v = 20, and total angular momentum states up to J = 33.5 in the fundamental (delta v = 1) and first overtone (delta v = 2) manifolds. The calculated intensities were obtained with an accurate representation of the electronic dipole moment function of nitric oxide and wavefunctions generated from a numerical RKR potential taking full account of rotation-vibration coupling and spin-uncoupling. In addition to the detailed line

emission data, thermally averaged vibrational band intensities are provided for application to low resolution studies.
Author (GRA)

N76-27100# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EVAPORATION OF SOLID BODY, WHICH ABSORBS RADIANT ENERGY
Ye M. Shakhov 10 Dec. 1975 39 p refs Transl. into ENGLISH from Inzh. Zh., Izd-vo Akad. Nauk SSSR (USSR), v. 1, no. 4, 1961 p 27-38
(AD-A019141; FTD-ID(RS)-T-2298-75) Avail: NTIS CSCL 20/13

The heating of a solid body, which absorbs radiant energy, was studied. With sufficient radiant energy flow, the surface of the body can achieve such a high temperature that the physiochemical conversions of the material are unavoidable. Emphasis was placed upon the one-dimensional problem of the evaporation of the solid body, heated from the incident radiant energy. It is assumed that the flow of radiant energy is absorbed on the surface of the body and is equivalent to the thermal flow q on the boundary whose value depends on time t and on the surface temperature. There are two cases of surface evaporation examined: body evaporation and evaporation into the medium filled far from the body. Author (GRA)

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N76-27101*+ National Aeronautics and Space Administration, Washington, D.C.
MANAGEMENT: A CONTINUING LITERATURE SURVEY WITH INDEXES, MARCH 1976
Mar. 1976 113 p
(NASA-SP-7500(10)) Avail: NTIS HC $5.50 CSCL 05A

Management is a compilation of references to selected reports, journal articles, and other documents on the subject of management. This publication lists 368 documents originally announced in the 1975 issues of Scientific and Technical Aerospace Reports (STAR) or International Aerospace Abstracts (IAA). It includes references on the management of research and development, contracts, production, logistics, personnel, safety, reliability and quality control. It also includes references on: program, project and systems management; management policy, philosophy, tools, and techniques; decisionmaking processes for managers; technology assessment; management of urban problems; and information for managers on Federal resources, expenditures, financing, and budgeting. Author

N76-27102*# National Aeronautics and Space Administration, Washington, D.C.
CONTRACTOR RELATIONSHIPS AND INTER-ORGANIZATIONAL STRATEGIES IN NASA'S R AND D ACQUISITION PROCESS
Joseph Guiltinan Jul. 1976 83 p refs
(NASA-TM-X-74314) Avail: NTIS HC $5.00 CSCL 05A

Interorganizational analysis of NASA's acquisition process for research and development systems is discussed. The importance of understanding the contractor environment, constraints, and motives in selecting an acquisition strategy is demonstrated. By articulating clear project goals, by utilizing information about the contractor and his needs at each stage in the acquisition process, and by thorough analysis of the inter-organizational relationship, improved selection of acquisition strategies and business practices is possible. Author

N76-27103*# National Materials Advisory Board, Washington, D.C.
AEROSPACE COST SAVINGS: IMPLICATIONS FOR NASA AND THE INDUSTRY Final Report
1975 132 p refs
(Contract NASw-2371)
(NASA-CR-148224; PB-249463/1; NMAB-326) Avail: NTIS HC $6.00 CSCL 15E

Factors that have a major influence on cost in airframe, engine, and helicopter procurement and operation are identified; current cost-reduction efforts are reviewed; and technical programs that offer potential for lowering costs are proposed for possible implementation by NASA. In view of the growing impact of increasing fuel costs on the life cycle cost of aircraft vehicles, major attention is given to operating and maintenance costs as well as to manufacturing costs. Seven general conclusions are reached, recommendations made, and thirty-two specific programs are proposed. GRA

N76-27104# West Virginia Univ., Morgantown. Dept. of Industrial Engineering.
OPTIMIZATION MODEL FOR PRODUCTION SCHEDULING AND SEQUENCING OVER MULTIPURPOSE PROCESSORS Final Report
Arup K. Mallik and Richard A. Jackson Mar. 1975 318 p
(Grant NSF GK-37379)
(PB-249023/3; WVU-IE-75-02) Avail: NTIS HC $9.75 CSCL 05A

The problem is that of scheduling many products on a single production facility so as to minimize total cost subject to the constraint that no two products can be produced concurrently. Scheduling is accomplished over a finite planning horizon during which time it is assumed that both production and demand rates are known and constant. The total cost of a schedule is computed by summing labor costs, including shift differential and overtime wages, raw material reorder and inventory costs, finished goods inventory and backorder cost, and sequence dependent setup cost. GRA

N76-27105# Office of Naval Research, Arlington, Va.
GOVERNMENT PATENT POLICY: TIME FOR COMPROMISE
William Otis Quesenberry 1975 61 p refs Repr. from IDEA, v. 17, no. 1, 1975 p 5-58
(PB-249188/4) Avail: NTIS HC $4.50 CSCL 05A

The results of research and development lead to processes and products which have potentially marketable use, but such use is often-times abrogated by governmental policy. The disparate patent policies applied to research programs are based both on legislative and executive action resulting in provisions with either no policy statement at all or one that is very specific and highly restrictive. Two schools of thought disagree as to title to invention derived from government funds: (1) that the government should acquire only those rights to invention which it needs for governmental purposes; or (2) that the government should acquire all rights to inventions conceived under governmment-sponsored research. GRA

N76-27106# National Conference of State Legislatures, Denver, Colo. Committee on Science and Technology.
MEETING THE CHALLENGE: SCIENTIFIC AND TECHNICAL STAFF IN STATES' LEGISLATURES
Edward L. Helminski, ed. and Ralph Marcelli, ed. Jul. 1975 164 p refs
(Grant NSF GT-39414)
(PB-249051/4; NSF/RA/G-75-22) Avail: NTIS MF $2.25; HC available from the Council of State Governments, Iron Works Pike, Lexington, Ky. 40511. HC $5.00 CSCL 05A

The National Conference of State Legislatures' Committee on Science and Technology actively stimulates state legislatures to develop their own scientific and technical resources for policy-making. Existing state legislative scientific and technical staff functions are reported. Descriptions of state efforts from 1970, when specifically designated legislative scientific staff functions existed only in California and New York, to the 11

states which presently have scientific staff functions are included. These mechanisms are described to serve as guides for establishing similar mechanisms, and to demonstrate how they were adapted to best serve individual state needs. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software.*

N76-27107 British Library Lending Div., Boston Spa (England).
A COMPUTER SIMULATION MODEL OF LIBRARY OPERATIONS BASED ON THE ASLIB/PSTI STUDY ON THE USE OF BIBLIOGRAPHIC RECORDS IN LIBRARIES: A PILOT STUDY
Pauline A. Thomas and Stephen E. Robertson Dec. 1973 86 p refs
(BLL-OSTI-5186-(6312.365F)) Avail: British Library Lending Div., Boston Spa, Engl.

The development of modular simulation models of aspects of library systems in order to investigate the use of such models as aids to systems design and operation is discussed. A conceptual model of library procedures, developed during a project on the use of bibliographic records in libraries, offered a suitable basis for a pilot study. The pilot study was aimed at investigating the precticality of developing and using simulation models of library operations, and gaining experience in the application of simulation techniques to problems in the library and information field. Author

N76-27108 British Library Lending Div., Boston Spa (England).
ALTERNATIVES TO THE SCIENTIFIC PERIODICAL. A REVIEW OF METHODS REPORTED IN THE LITERATURE
J. Aitchison Mar. 1974 27 p refs
(BLL-OSTI-5190-(6312.365F)) Avail: British Library Lending Div., Boston Spa, Engl.

Alternatives to periodical publication of scientific journals are discussed. Proposals, experiments and operational systems are summarized. Author

N76-27109 British Library Lending Div., Boston Spa (England).
UNDERGRADUATES AND BOOKS
Peter H. Mann, ed. Mar. 1976 82 p refs Workshop held in Sheffield, England, 21-23 Mar. 1975
(BLL-RDR-5258-(2113.56F)) Avail: British Lending Library Div., Boston Spa, Engl.

Papers are presented dealing with information needs of students and how these needs are fulfilled. The role of books in this process is emphasized. J.M.S.

N76-27110 British Library Lending Div., Boston Spa (England).
INTERNATIONAL RESEARCH FORUM IN INFORMATION SCIENCE: THE THEORETICAL BASIS OF INFORMATION SCIENCE, 29 JULY - 2 AUGUST, 1975
B. C. Vickery, S. E. Robertson, and N. J. Belkin 1975 93 p refs
(BLL-RDR-5262-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

The general questions discussed at the conference were: (1) the phenomena, ie the problems to be solved; (2) the kind of science needed to solve such problems, e.g. statistical or causal; and (3) the formalisms needed to apply in solving such problems, ie the techniques of mathematics, logics, semantics, syntactics. Author

N76-27111 British Library Lending Div., Boston Spa (England).
DESIGN OF INFORMATION SYSTEMS IN THE SOCIAL SCIENCES. RESEARCH REPORT SERIES B, NO. 4: CHARACTERISTICS OF SOCIAL SCIENCE SERIALS. THE CONSTRUCTION AND ANALYSIS OF A FILE OF SOCIAL SCIENCE SERIAL TITLES
David Nichols, Maureen Ritchie, and Robert Bradshaw 1975 164 p refs
(BLL-RDR-5269-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

Bibliographical and bibliometric studies of serial publications in the social sciences are reported. Emphasis is placed on the compilation and analysis of the Check List of Social Science Serials (CLOSSS). Further analyses of different aspects of the CLOSSS data are dealt with along with the size, growth and composition of the monograph literature. Author

N76-27112 Royal Coll. of Art, London (England). Readability of Print Research Unit.
FACTORS AFFECTING THE ACCEPTABILITY OF MICROFORMS AS A READING MEDIUM
Herbert Spencer and Linda Reynolds Feb. 1976 93 p refs Sponsored by British Library
(BLL-RD-5275-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

As an information handling medium, microforms possess numerous advantages over conventional alternatives, and their use in the area of information publishing is increasing rapidly. As a reading medium however, microfilms have a number of disadvantages given the present state-of-the-art. These disadvantages and their psychological and physiological effects on the user are examined. Author

N76-27113# Oak Ridge National Lab., Tenn.
ASSESSING DATA NEEDS AND RELATED CRITERIA, DISCUSSION OF ENVIRONMENTAL DATA
A. H. Voelker 1975 11 p Presented at the Meeting on Environ. Analysis Tech. and Procedures for Siting Utility Systems, Madison, Wisc., 20-24 Oct. 1975 Sponsored by ERDA
(CONF-751057-1) Avail: NTIS HC $4.50

Data are of fundamental importance to the route selection process. Its selection and manipulation unfortunately are still as much art as science. The purpose of this discussion was to enumerate some of these points. Data loses content through abstraction. All data contains error, and systematic procedures are required to reduce it. For reasons of economy and ease of interpretation, data should be reduced to an essential subset needed for a particular analysis. Unique scales best fit the various levels of siting analysis. Resolution of individual datum can limit the resolution of the analysis. Computers can be a significant tool to the planner if used properly in a cost-conscious way. Author (ERA)

N76-27114 Reading Univ. (England).
INFORMATION BLOW BETWEEN PRIMARY JOURNALS AND SECONDARY SERVICES IN THE BIOLOGICAL FIELD Final Report
N. Landau and R. B. Weiss 1976 89 p
(BLL-RDR-5239-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

Standard guidelines were developed for abstracts of different types of biological papers, in order to improve the quality of abstracts in primary journals and facilitate their use by secondary services. Abstracts of papers from 240 representative biological journals were submitted for evaluation to four user panels made up of thirty-five scientists from thirteen countries, and one panel of secondary journal editors; all abstracts conformed to provisional guidelines developed in a preliminary pilot project. The original objective of developing definitive guidelines to cover abstracts for various types of biological papers was discarded as impractical, and replaced by a two-stage approach by the panels. This consisted of brief, standardized notes on abstract writing, and detailed back-up information for editors to submit to authors. The back-up information incorporated a check-list of elements potentially valuable in an abstract, and examples relevant to the journal. It is proposed that this two-stage approach be evaluated in practice. Author

N76-27115 British Library Lending Div., Boston Spa (England).
REPORT ON THE NEED FOR AND PROVISION OF AN 'IDEAL' INFORMATION RETRIEVAL TEST COLLECTION
K. Sparck Jones Dec. 1975 44 p refs
(BLL-RDR-5266-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

Requirements for a computerized information retrieval system

test collection are presented. The structure, indexing terms, and search routines for several existing data bases are shown. A.S.K.

N76-27116 Newcastle-upon-Tyne Univ. (England).
THE SUBJECT INTENSITY OF LIBRARY USE: SOME ASPECTS OF POLYTECHNIC LIBRARY
Colin Harris Oct. 1975 160 p
(BLL-RDR-5267-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

Library use in polytechnics was studied. The libraries of three polytechnics representing different levels of library provision, were analyzed in terms of size and novelty of stock. Newer stock was found to be preferred almost universally, and larger stocks were more heavily used. Issues were compared with in-library uses of a 10% sample of the non-reference bookstock (n = 8483), and a very high correlation was found. Recorded in-library uses represented only 5% of all consultations overall and, in one class, only just over 2%. At one polytechnic, significant correlations were found, at the departmental level, between use by students of the set text (short loan) collection, periodical back issues, library study places and book borrowing (except between the last two). It was also found that more inter-library loans by teachers are used in preparation for teaching than for any other single purpose. Author

N76-27117 Newcastle Univ. (England).
THE MEDUSA CURRENT AWARENESS EXPERIMENT
Elizabeth Dick Barraclough, J. A. Hunter, A. J. Lovett, and B. N. Rossiter Oct. 1975 179 p
(BLL-RDR-5268-(2113.56F); TR-78) Avail: British Library Lending Div., Boston Spa, Engl.

A study of user behavior towards a current awareness information retrieval system is made using the Medusa on-line system. Investigations are made into the need for a frequent SDI service, the requirement to change the formulation over a period of time and related topics. Author

N76-27118 British Library, London (England).
INFORMATION PROBLEMS IN THE HUMANITIES. A REPORT ON THE BRITISH LIBRARY SEMINAR
O. B. Smith 1975 67 p
(BLL-RDR-5259-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

As part of the development of a program of research in humanities information the British Library Research and Development Department called together a group of academics and information workers in the humanities to discuss common problems and to define areas where research could be of value. Results of that conference are reported. Author

N76-27119 Institution of Electrical Engineers, London (England).
SEMI-AUTOMATIC DEVELOPMENT OF THESAURI USING FREE-LANGUAGE VOCABULARY ANALYSIS (PART 1 ONLY)
B. J. Field Jul. 1975 37 p refs
(BLL-RDR-5260-(2113.56F); ISBN-0-85296-430-7; R75/24) Avail: British Library Lending Div., Boston Spa, Engl.

Various techniques were studied for the computer analysis and manipulation of the free-language indexing assigned to documents in a data base to form the basis for the development of a structured vocabulary system or thesaurus based on free-language indexing. The development of an automatic truncation procedure is described, and the results of statistical studies on the growth and frequency characteristics of the free-language vocabulary are presented. The methods developed for handling free-language phrases and grouping and ranking terms for the notification of candidate thesaurus terms are discussed, and the results of small-scale tests are described. Author

N76-27120 Cambridge Univ. (England). Scientific Periodicals Library.
THE USE OF AN INTERACTIVE TERMINAL FOR INPUT AND EDITING OF BIBLIOGRAPHIC RECORDS, AND OTHER PROJECTS, PROPOSALS FOR R AND D Final Report, Feb. - Aug. 1975
C. J. Tucker 1975 68 p refs
(BLL-RDR-5253-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl.

Four research and development projects are outlined and cost estimates given. These include: (1) a quantitative comparison of the effectiveness of alternative methods of interactive input and editing of bibliographic records; (2) a systematic quality analysis of foreign MARC files; (3) bibliographic authority file checking using an interactive terminal; and (4) generalized MARC conversion software. Author

N76-27121 British Library Lending Div., Boston Spa (England). Research and Development Dept.
INVENTORY OF BIBLIOGRAPHIC DATA BASES PRODUCED IN THE UK
Jan. 1976 85 p
(BLL-RDR-5256-(2113.56F)) Avail: British Library Lending Div., Boston Spa, Engl. £2.50 or $5.00

Bibliographic data bases are defined as the content of abstracting or indexing services, whether published on printed lists or cards or in machine-readable form, covering documentary material. They include in-house products to which the public is allowed access, but exclude bibliographies and serial publications which announce new books or small numbers of highly selective references. The entries are arranged alphabetically by name of data base, but an alphabetical index of the responsible authorities and an alphabetical subject index are also provided. Author

N76-27122 British Library Lending Div., Boston Spa (England).
A NATIONAL TRANSPORT SYSTEM FOR INTER LIBRARY LOANS
A. G. Houghton and M. Nixon Feb. 1976 61 p refs
(BLL-RDR-5254-(2113.56F); ISBN-0-85350-1347; C223-LGORU) Avail: British Library Lending Div., Boston Spa, Engl.: £2.50 or $5.00

The feasibility and economic viability of setting up a national transport scheme to carry items on interlibrary loans between libraries and to and from BLLD was examined. Results include the following: the best form of system would consist of a regional road distribution system linked to BLLD at Boston Spa by a number of rail links; such a system would yield substantial savings to the library sector without any appreciable lowering of the level of service; the characteristics of a transport scheme would depend on the chosen method of pricing, and we have examined a variety of these; and the most suitable pricing method could best be selected by piloting the transport scheme in one or two areas. This would also enable implementation difficulties to be overcome before the introduction of the system on a national scale. Author

N76-27123 Loughborough Univ. of Technology (England).
AUTOMATED LIBRARY PROCESSES AND INTER DISCIPLINARY INFORMATION STUDIES. PART 1: AUTOMATED LIBRARY PROCESSES: GENERAL
M. E. Robinson and R. A. Wall Sep. 1975 95 p
(BLL-RDR-5250-(2113.56F)-Pt-1; LUT/Lib/R-9) Avail: British Library Lending Div., Boston Spa, Engl.

The current status of the Periodicals Data System (PDS) and the Minimal-Input Cataloguing System (MINICS) is reported. The PDS fixed-length field data can be stored economically in MINICS format if desired, and converted back to PDS format in order to use the available program package for the print-outs. The MINICS is being implemented for books and other individual items. The system's capabilities for cataloguing at two levels (serials/series, monographs/individual items) were tested. The format also includes 'analyticals/parts of items' level to permit application to special retrieval system requirements. All kinds of media are coverable, and MINICS is free from fixed-length constraints such as MARC's coding fields. The addition of a 'sort, nonprint' symbol to an already flexible system has made MINICS capable of sophistication comparable to MARC, and two-way conversion or interchange therewith if so desired, for example for sorting purposes. Author

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N76-27124 Yale Univ., New Haven, Conn.
A PERIODIC RESERVED SLOT STRATEGY FOR MANAGING VEHICLES ON AN AUTOMATED GUIDEWAY TRANSIT SYSTEM Ph.D. Thesis
Stephen Joseph Kiselewich 1975 174 p
Avail: Univ. Microfilms Order No. 76-13615

During the past several years, there has been growing interest in the problems associated with the design and operation of an Automated Guideway Transit (AGT) system; that is, a transportation system consisting of a large number of captive vehicles traveling at relatively close headways on an exclusive guideway under the control of a computer. A fundamentally new approach to the management of vehicles on AGT networks is presented which takes into account many important constraints which must be met on a a network under normal operating conditions. Techniques are developed for analyzing both networks on which vehicles can do no maneuvering and networks on which vehicles can do a nonzero but finite amount of maneuvering, and the usefulness of these techniques is demonstrated by means of example analyses of relatively complex AGT networks.
Dissert. Abstr.

N76-27125# Committee on Banking, Currency and Housing (U. S. House).
THE FEDERAL GOVERNMENT AND THE FUTURE OF URBAN LIFE
Washington GPO 1975 187 p Hearings before Comm. on Banking, Currency and Housing, 94th Congr., 1st Sess., 23-24 Jun. 1975
(GPO-56-653) Avail: Comm. on Banking Currency and Housing

The sociological, economic, and environmental problems of urban areas are considered. Governmental activities designed to alleviate these problems are evaluated. D.M.L.

N76-27126# National Bureau of Standards, Washington, D.C.
DIMENSIONS/NBS, VOLUME 60, NUMBER 1, JANUARY 1976 Monthly Technical News Bulletin
Jan. 1976 24 p
(PB-248904-01; NBS/DIM-60/1; LC-25-26527) Avail: NTIS MF $2.25; HC available from SOD CSCL 05B

A monthly magazine is examined which features short summaries of major technical developments, highlights of work in progress, major speeches and statements by The National Bureau of Standards management, and also a listing of National Bureau of Standards (NBS) publications. The table of contents for the current issue is: NBS develops new mercury monitor; An EPIC undertaking--out of the classroom, into the plant; Metal fires--science and safety; government primes the industrial pump; computer user's guide published by NBS; DOC-GSA cooperate in purchase of more efficient kitchen ranges; NBS makes computer network access easier; complete set of FIPS available from NBS; NBS, EPRI sign cooperative agreement on energy measurement technology; NBS establishes speakers bureau for metric information. GRA

N76-27127# Arizona Univ., Tucson. Engineering Experiment Station.
DEFINE AN EXPERIMENT IN APPLICATION OF SPECIFIC MILITARY/SPACE DEVELOPMENTS TO THE PUBLIC SECTOR Final Report
Stuart A. Hoenig 21 Nov. 1975 17 p
(Grants NSF RD-173-07279-A02; NSF DI-39554)
(PB-248111/7; UAZ/EES-07279-F) Avail: NTIS HC $3.50 CSCL 05A

Efforts to transfer military/space technology to the private sector are discussed. The results indicate that industrial funding can be obtained but it may require some changes in attitude by university faculty. A discussion of techniques for making contact with industry and generating industrial research support is included. GRA

N76-27128# Transportation Data Coordinating Committee, Washington, D.C.
ELECTRONIC SYSTEMS SERVE TRANSPORTATION
1974 170 p Natl. Forum (6th) held at Washington, D. C., 3-4 Dec. 1974
(PB-249510/9) Avail: NTIS HC $6.75 CSCL 13B

Contents: Computers serve transportation; Data communications serve transportation; Modernizing data interchange systems; Railroad data systems; Motor carrier use of electronic systems; Steel customer communications system; IATA cargo automation research project; computer science and technology in business; Packet switching concept; New technologies for transportation; Transportation information systems in Canada; Transporation data interchange systems; Tariffs - innovation and progress; Coding for data exchange and tariffs. GRA

N76-26237 Rockwell International Corp., El Segundo, Calif.
EXOINDUSTRIALIZATION IN PERSPECTIVE
In its Space Ind. Productivity New Options for the Future Jul. 1975 p 14-27 (For availability see N76-26235 17-12)

88 SPACE SCIENCES (GENERAL)

N76-27129# Executive Office of the President, Washington, D.C.
AERONAUTICS AND SPACE REPORT OF THE PRESIDENT, 1975 ACTIVITIES
Gerald R. Ford 1975 116 p
Avail: NTIS MF $2.25; SOD HC $1.85

Achievements in aeronautics and space in 1975 are summarized. Scientific investigations which have advanced understanding of the universe, the solar system, and the earth's space environment, atmosphere, and surface features are included along with the increased reliability and diversity of operational satellite systems for weather data and communications. The Apollo Soyuz Test Project, progress on the space shuttle, and aeronautical research into quieter, more economical, and safer aircraft are among the topics discussed. Author

N76-27130# Princeton Univ., N.J.
POWER SATELLITE CONSTRUCTION FROM LUNAR SURFACE MATERIALS
Gerard K. ONeill 1976 26 p refs Presented at the Subcomm. on Aerospace Technol. and Natl. Needs of the Comm. on Aeron. and Space Sci., US Senate, Washington, D. C., 19 Jan. 1976
Avail: NTIS HC $4.00

Orbital manufacturing of satellite power stations from lunar surface materials is considered. Economic factors are emphasized. J.M.S.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N76-27131 Brigham Young Univ., Provo, Utah.
INTERMEDIATE-BAND PHOTOMETRY OF SHORT PERIOD DWARF CEPHEID VARIABLES Ph.D. Thesis
Wilbur Reed Langford 1976 107 p
Avail: Univ. Microfilms Order No. 76-13575

Intermediate-band photometric observations of nine dwarf cepheids and two RR Lyrae stars have been obtained in the UV with a photometric system. Intrinsic color indices, temperatures, gravities, absolute magnitudes, masses, and a chemical composition indicator are derived from the photometry. The results of the investigation indicate (1) the dwarf cepheids exhibit a large range in metal abundance, (2) the metal-poor stars are high-velocity objects exhibiting the shortest periods of pulsation, (3) the variables fall into the instability strip in the H-R diagram and exhibit a period-temperature relation, (4) the dwarf cepheids obey a period-luminosity relation with the stars of longest period being the most luminous, and (5) the metal-strong variables have masses of about 2 solar masses while the metal-poor variables appear to have masses less than one solar mass. Dissert. Abstr.

N76-27132# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
ROCKET INFRARED SPECTROSCOPY OF THE ZODIACAL DUST CLOUD Ph.D. Thesis
Daniel A. Briotta, Jr. May 1976 88 p refs
(CRSR-635) Avail: NTIS HC $5.00

The 8-14 micron infrared spectrum of the zodiacal dust cloud was measured. The observations were made with a liquid helium cooled array spectrometer and telescope from an altitude of approximately 300 km. The design, testing, and calibration of the rocket payload are described. The spectrum shows a pronounced silicate emission feature similar to that seen in carbonaceous chondrites and in the Orion Nebula, along with a dilute underlying black body. Author

N76-27133*# Kanner (Leo) Associates, Redwood City, Calif.
THRESHOLD LUMINOSITY OF ACCRETIONS BY A NEUTRON STAR WITH A MAGNETIC FIELD
M. M. Basko and R. A. Syunyayev Washington NASA Jun. 1976 47 p refs Transl. into ENGLISH of Russian report Pr-243 (Moscow), 175 48 p
(Contract NASw-2790)
(NASA-TT-F-15465; PR-243) Avail: NTIS HC $4.00 CSCL 03A

Accretion of matter by a magnetized neutron star, in the case of large mass fluxes, when the reaction of the outgoing radiation cannot be disregarded, is examined. Luminance at which the outgoing radiation must be taken into account was calculated. It was shown that the limiting X-ray luminance of accretions by a neutron star with a magnetic field depends strongly on accretion channel geometry and can exceed the critical Eddington value. Effects connected with flow around the magnetosphere of the neutron star are discussed in detail. It was shown that the layer of gas must be optically thick with respect to Thomson scattering and that it can reradiate a significant portion of the primary flux in the soft range. A necessary condition for supercritical luminance is asymmetric flow around the Alfven surface. Regular pulsations of both hard and soft X-rays are discussed within the framework of the proposed model. Author

N76-27134*# California Inst. of Tech., Pasadena. Radiation Lab.
THE RELATIVISTIC EQUATIONS OF STELLAR STRUCTURE AND EVOLUTION. STARS WITH DEGENERATE NEUTRON CORES. 1: STRUCTURE OF EQUILIBRIUM MODELS
Kip S. Thorne and Anna N. Zytkow May 1976 72 p refs Prepared in cooperation with Polish Acad. of Sci., Warsaw
(Grants NGR-05-002-256; NSF-AST75-01398-A01)
(NASA-CR-148213; OAP-453) Avail: NTIS HC $4.50 CSCL 03A

The general relativistic equations of stellar structure and evolution are reformulated in a notation which makes easy contact with Newtonian theory. Also, a general relativistic version of the mixing-length formalism for convection is presented. Finally, it is argued that in previous work on spherical systems general relativity theorists have identified the wrong quantity as 'total mass-energy inside radius r.' Author

N76-27135*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
X-RAY EMISSION FROM THE SUPERNOVA REMNANT G287.8-0.5
R. H. Becker, E. A. Boldt, S. S. Holt, S. H. Pravdo, R. E. Rothschild, P. J. Serlemitsos, and J. H. Swank Jun. 1976 10 p refs Submitted for publication
(Grant NGR-21-002-316)
(NASA-TM-X-71131; X-661-76-113) Avail: NTIS HC $3.50 CSCL 03A

The GSFC Cosmic X-ray spectroscopy experiment on OSO-8 observed a weak galactic X-ray source near theta 2 at 288 deg, b2 at -1 deg. The spectrum for this source between 2-20 keV is well represented by a thermal spectrum of kT = 7.34(+3.6), sub -2.6 keV with an intense iron emission line centered at 6.5 + or - .2 keV. The error box of the Uhuru source 4U1043-59, the only known X-ray source in our field of view, contains the radio supernova remnant G287.8-0.5. The possible association of the X-ray source with this supernova remnant is discussed. Author

N76-27136*# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
A SPHERICAL LAMELLAR GRATING INTERFEROMETER FOR AIRBORNE ASTRONOMICAL OBSERVATIONS OF FAR INFRARED OBJECTS
J. L. Pipher, M. P. Savedoff, and J. G. Duthie [1976] 17 p refs
(Grant NGR-33-019-127)
(NASA-CR-148192) Avail: NTIS HC $3.50 CSCL 03A

A lamellar grating has been developed to be used for very far infrared observations on the airborne observatory. The design characteristics and performance during laboratory testing and initial observations of Jupiter at wavelengths between 50 and 500 microns are presented. Author

N76-27137*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
NATURAL ENVIRONMENT DESIGN REQUIREMENTS FOR THE SPACE TELESCOPE
George S. West and Jerry J. Wright Jul. 1976 36 p refs
(NASA-TM-X-73316) Avail: NTIS HC $4.00 CSCL 03A

The natural environment design requirements for the Large Space Telescope are presented. Because the Large Space Telescope is to be carried as cargo to orbital altitudes in the space shuttle bay, orbital environment impacts are emphasized. Author

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N76-27138 California Univ., San Diego.
INFRARED SPECTROPHOTOMETRY AND RADIATIVE TRANSFER IN OPTICALLY THICK CIRCUMSTELLAR DUST ENVELOPES Ph.D. Thesis
Kenneth Michael Merrill 1976 262 p
Avail: Univ. Microfilms Order No. 76-12865

Broad and narrow bandpass photometry was used to determine the properties of a large sample of numerous, compact, isolated, and bright infrared sources which have not been identified with previously catalogued stars. The spectra of all cool carbon stars surveyed contain an as yet unidentified 3.07 micrometers

absorption band, joined by absorption at 3.9 micrometers and longward of 2.4 micrometers in many cases. An as yet unidentified emission band at 3.28 micrometers seen in conjunction with emission bands at 8.7 micrometers and 11.3 micrometers is seen in several hotter infrared sources. Most of the sources observed appear to be stars of spectral type M and C which are differentiated from normal cool comparison stars only by the presence of extensive circumstellar dust envelopes. However, no evidence of a cool stellar atmosphere was found for a number of objects, several of which are located in dense molecular clouds. Finally, a few sources appear in conjunction with peculiar reflection nebulae which require disc-like, dense, dust envelopes. Dissert. Abstr.

N76-27139# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research.
PROBLEMS OF MATTER-ANTIMATTER BOUNDARY LAYERS
B. Lehnert 21 Dec. 1975 23 p refs
(TRITA-EPP-76-04) Avail: NTIS HC $3.50

The problems of the quasi-steady matter-antimatter boundary layers discussed in Klein-Alfven's cosmological theory and a crude model of the corresponding ambiplasma balance are presented. At interstellar particle densities, no well-defined boundary layer can exist in the presence of neutral gas, nor can such a layer be sustained in an unmagnetized fully ionized ambiplasma. Within the limits of applicability of the present model, sharply defined boundary layers are, under certain conditions, found to exist in a magnetized ambiplasma. Thus, at beta values less than unity, a steep pressure drop of the low-energy components of matter and antimatter can be balanced by a magnetic field and the electric currents in the ambiplasma. The order of magnitude of the boundary layer thickness is given as a function of the magnetic field strength in MKS units and the characteristic temperature of the low-energy components in the layer. Author (ESA)

N76-26800* Harvard Coll. Observatory, Cambridge, Mass.
THEORIES OF THE ORIGIN AND NATURE OF THE UNIVERSE
A. G. W. Cameron *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 3-31 refs (For availability see N76-26799 17-52)
CSCL 03B

N76-26801* Moscow State Univ. (USSR). Scientific Research Inst. of Nuclear Physics.
PHYSICAL CHARACTERISTICS OF INTERPLANETARY SPACE
S. N. Vernov, Yu. I. Logachev, and N. F. Pisarenko (Acad. of Sci., Moscow) *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 32-111 refs (For availability see N76-26799 17-52)
CSCL 03B

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N76-27140 Washington Univ., St. Louis, Mo.
EXPOSURE AGE DATING OF LUNAR FEATURES: LUNAR HEAVY RARE GASES Ph.D. Thesis
Claire Joyce Morgan 1975 165 p
Avail: Univ. Microfilms Order No. 76-14074

The technique of cosmic-ray exposure age dating is examined. The (kr-81)-kr exposure dating method is developed and evaluated along with other techniques. Primarily, the krypton method is used to date the time of formation of several lunar features. Because it became apparent that ages could be derived regardless of the data, a set of criteria is established by which the reliability of the ages deduced can be judged. Krypton and xenon from samples from the Apollo 14, 16 and 17 landing sites are reported. The time of formation of Cone Crater (26 my), North Ray (50 my), and South Ray (2my) is established. Though the Apollo 17 mission had ideal sampling conditions to date several features, only the times of emplacement of the boulder slides at stations 6 (22 my) and 7 (28 my) are firmly established. Dissert. Abstr.

N76-27141*# Agnew Tech-Tran, Inc., Woodland Hills, Calif.
THE LUNAR FEATURES OF MERCURY
G. A. Burba Washington NASA Jun. 1976 17 p Transl. into ENGLISH from Priroda (USSR), no. 3, Mar. 1976 p 77-89
(Contract NASw-2789)
(NASA-TT-F-17041) Avail: NTIS HC $3.50 CSCL 03B

Photo-telemetry on Mercury, obtained by means of the Mariner-10 space probe, has made it possible to study the planet's geologic history. The fact that its mean density is the same as the earth (5.5 g/cu cm), and that its size is small (the diameter of mercury is 4880 km--i.e., more than one-third that of the earth) had resulted in the initial presumption of a unique history in the development of Mercury's surface. Instead, a striking similarity to the moon's surface has been discovered. The Mariner-10 research made it possible to study optical properties of the surface, craters and circular basins, plains and specific relief features of Mercury. It has been established that there are large circular basins and craters on the Moon, Mars and Mercury; this indicates the uniformity relief formation processes. On all of these heavenly bodies an asymmetry is observed in the distribution of the basic surface subdivisions--heavily cratered areas and plains. This peculiarity must be accepted as a common formation feature for earth group planets. Author

N76-27142*# California Univ., Los Angeles. Seismological Lab.
IMPACT EJECTA ON THE MOON
John D. OKeefe 11 Jun. 1976 41 p refs Revised
(Grant NsG-7129)
(NASA-CR-148290; Contrib-2763) Avail: NTIS HC $4.00 CSCL 03B

The partitioning of energy and the distribution of the resultant ejecta on the moon is numerically modeled using a Eulerian finite difference grid. The impact of an iron meteoroid at 15 km/sec on a gabbroic anorthosite lunar crust is examined. The high speed impact induced flow is described over the entire hydrodynamic regime from a time where the peak pressures are 6 Mbar until the stresses everywhere in the flow are linearly elastic, and less than 5 kbar. Shock-induced polymorphic phase changes, (plagioclase and pyroxene to hollandite and perovskite), and the subsequent reversion to low pressure phases are demonstrated to enhance shock wave attenuation. A rate-dependent equation of state is used for describing the hysteretic effect of the phase change. Ballistic equations for a spherical planet are then applied to material with net velocity away from the moon. Author

N76-27143*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
THE SURFACE CHEMICAL COMPOSITION OF LUNAR SAMPLES AND ITS SIGNIFICANCE FOR OPTICAL PROPERTIES
T. Gold, E. Bilson, and R. L. Baron Apr. 1976 24 p refs Presented at the 7th Lunar Sci. Conf. Submitted for publication
(Grants NGL-33-010-005; NGR-33-010-137)
(NASA-CR-148169; CRSR-634) Avail: NTIS HC $3.50 CSCL 03B

The surface iron, titanium, calcium, and silicon concentration in numerous lunar soil and rock samples was determined by Auger electron spectroscopy. All soil samples show a large increase in the iron to oxygen ratio compared with samples of pulverized rock or with results of the bulk chemical analysis. A solar wind simulation experiment using 2 keV energy alpha -particles showed that an ion dose corresponding to approximately 30,000 years of solar wind increased the iron concentration on the surface of the pulverized Apollo 14 rock sample 14310 to the concentration measured in the Apollo 14 soil sample 14163, and the albedo of the pulverized rock decreased from 0.36 to 0.07. The low albedo of the lunar soil is related to the iron + titanium

concentration on its surface. A solar wind sputter reduction mechanism is discussed as a possible cause for both the surface chemical and optical properties of the soil. Author

N76-27144*# Transemantics, Inc., Washington, D.C.
SPACECRAFT STUDY OF THE SOLAR SYSTEM
G. A. Skuridin Washington NASA Jun. 1976 50 p Transl. into ENGLISH from Novoye v Zhizni Nauke, Tekhinike, Seriya Kosmonavtika, Astronomiya (USSR), no. 11, 1975 p 27-58
(Contract NASw-2792)
(NASA-TT-F-15496) Avail: NTIS CSCL 03B

Developments are described in the achievements of Soviet and American space scientists in studying various celestial bodies by spacecraft. Particular attention is devoted to information gathered on the Moon, Mars, Jupiter, Mercury, Venus and Saturn. Author

N76-27145*# Transemantics, Inc., Washington, D.C.
VENUS SURFACE PICTURES
F. Zigel NASA Jun. 1976 22 p Transl. into ENGLISH from Tekhnika Molodezhi (USSR), no. 12, 1975 p 30-34
(Contract NASw-2792)
(NASA-TT-F-16922) Avail: NTIS HC $3.50 CSCL 03C

Pictures of the Venus landscape transmitted from Venus are presented. A summary of known facts about Venus is included, as are also comparative data on the atmospheres of Earth, Mars and Venus, together with a diagram of comparative altitudinal distributions of all three atmospheres up to 88 km. It is noted that at 50-55 km altitude, Venus conditions (pressure, atmosphere) resemble those of earth. Author

N76-27146*# Battelle-Northwest, Richland, Wash.
POLARIZATION STUDIES OF URANUS Final Report, 1 May 1975 - 15 Jun. 1976
Joseph J. Michalsky 15 Jun. 1976 14 p refs
(Grant NsG-7134)
(NASA-CR-148211) Avail: NTIS HC $3.50 CSCL 03B

The whole-disk polarization of Uranus was measured over two apparitions in blue and red light. The behavior of the blue polarization as a function of phase angle is indicative of non-Rayleigh scattering. The red polarization phase curve, while not necessarily suggesting Rayleigh scattering, is at least consistent with that interpretation. One explanation of these data is that the blue radiation is scattered by the CH4 haze layer suggested by others for Uranus while red radiation, because of methane absorptions above this layer, does not penetrate to or scatter significantly from this haze layer. There is no whole-disk circular polarization, as expected, confirming other observations and theoretical predictions. In addition, polarization measurements of Comet West were carried out after perihelion. The results indicate that large particles are primarily responsible for the scattering of continuum light. Author

N76-27147*# Transemantics, Inc., Washington, D.C.
INFRARED SPECTROSCOPY OF THE MOON FROM THE SALYUT-4 ORBITAL STATION
M. N. Markov, G. M. Grechko, A. A. Gubarev, Yu. S. Ivanov, and V. S. Petrov NASA May 1976 16 p refs Transl. into ENGLISH of "Infrakrasnaya Spektroskopiya Luny s Orbitalnoy Stantsii Salyut-4", Preprint no. 7 Levedev Inst. of Physics, Acad. of Sci. USSR, Moscow, 1976 16 p
(Contract NASw-2792)
(NASA-TT-F-17013) Avail: NTIS HC $3.50 CSCL 03B

An experiment to determine the lunar radiation spectrum in the band of 1 to 8 micron was set up on the Salyut-4 orbital piloting station. This band encompasses significant portions of the spectrum in which reflected and characteristic lunar radiation is concentrated. An ITS-K Infrared telespectrometer developed at the P.N. Levedev Physics Institute of the USSR Academy of Sciences was used for the observations. The observations of the moon were carried out on the 514th revolution of the Salyut-4 station's flight, during the full moon. It is concluded that the spectra of lunar radiation and the laboratory spectra of the surface fraction of the lunar soil (regolith) are generally (depending upon the nature of the spectrum) similar. Author

N76-27148*# Rensselaer Polytechnic Inst., Troy, N.Y.
DATA ACQUISITION AND PATH SELECTION DECISION MAKING FOR AN AUTONOMOUS ROVING VEHICLE Progress Report, 1 Jan. - 30 Jun. 1976
D. K. Frederick, C. N. Shen, and S. W. Yerazunis 1 Jul. 1976 46 p refs
(Grant NsG-7184)
(NASA-CR-148296) Avail: NTIS HC $4.00 CSCL 03B

Problems related to the guidance of an autonomous rover for unmanned planetary exploration were investigated. Topics included in these studies were: simulation on an interactive graphics computer system of the Rapid Estimation Technique for detection of discrete obstacles; incorporation of a simultaneous Bayesian estimate of states and inputs in the Rapid Estimation Scheme; development of methods for estimating actual laser rangefinder errors and their application to date provided by Jet Propulsion Laboratory; and modification of a path selection system simulation computer code for evaluation of a hazard detection system based on laser rangefinder data. Author

N76-26802* California Univ., San Diego.
THE MOON AND ITS NATURE
Harold C. Urey *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 115-132 refs (For availability see N76-26799 17-52)
(Grant NGR-05-009-150)
CSCL 03B

N76-26803* Academy of Sciences (USSR), Moscow. Inst. of Applied Mathematics.
EARTH-TYPE PLANETS (MERCURY, VENUS, AND MARS)
M. Ya. Marov and V. D. Davydov *In* NASA, Washington Found. of Space Biol. and Med., Vol. 1 1975 p 133-196 refs (For availability see N76-26799 17-52)
CSCL 03C

N76-26804* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PLANETS AND SATELLITES OF THE OUTER SOLAR SYSTEM, ASTEROIDS, AND COMETS
Ray L. Newburn, Jr. and Samuel Gulkis *In its* Found. of Space Biol. and Med., Vol. 1 1975 p 197-268 refs (For availability see N76-26799 17-52)
(Contract NAS7-100)
CSCL 03C

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N76-27149*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
OBSERVATIONS OF LIMB FLARES WITH A SOFT X-RAY TELESCOPE
Edward G. Gibson 16 Feb. 1976 69 p refs
(Contract NAS8-29602)
(NASA-CR-144329; ATR-76(7405)-2) Avail: NTIS HC $4.50 CSCL 03B

The structure and evolution of 26 limb flares have been observed with a soft X-ray telescope flown on Skylab. The results are: (1) One or more well defined loops were the only structures of flare intensity observed during the rise phase and near flare maximum, except for knots which were close to the resolution of the telescope; (2) the flare core features were always sharply defined during rise phase; and (3) for the twenty events which contained loops, the geometry of the structure near maximum was that of a loop in ten cases, a loop with a spike at the top in four cases, a cusp or triangle in four cases, and a cusp combined with a spike in another two cases. Based on observation of the original film, it is suggested that flares which underwent large scale deformations had become unstable to MHD kinks. This implies that these flares occurred in magnetic flux tubes through which significant currents were flowing. Author

N76-27150*# Stanford Univ., Calif. Inst. for Plasma Research.
THE SUN'S MAGNETIC SECTOR STRUCTURE Technical Report, 1959-1973

Leif Svalgaard, John M. Wilcox, Phillip H. Scherrer, and Robert Howard Aug. 1975 20 p refs
(Grant NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF DES-74-19007)
(NASA-CR-148282; AD-A018766; SU-IPR-639) Avail: NTIS HC $3.50 CSCL 03/1

The synoptic appearance of solar magnetic sectors is studied using 454 sector boundaries observed at earth during 1959-1973. The sectors are clearly visible in the photospheric magnetic field. Sector boundaries can be clearly identified as north-south running demarcation lines between regions of persistent magnetic polarity imbalances. These regions extend up to about 35 deg of latitude on both sides of the equator. They generally do not extend into the polar caps. The polar cap boundary can be identified as an east-west demarcation line marking the poleward limit of the sectors. The typical flux imbalance for a magnetic sector is about 4 x 10 to the 21st power Maxwells. Author (GRA)

N76-27151*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESULTS OF CORONAL HOLE RESEARCH: AN OVERVIEW
Robert M. Wilson Jul. 1976 38 p refs
(NASA-TM-X-73317) Avail: NTIS HC $4.00 CSCL 03B

An overview of the last 10 years of coronal hole research, in particular since 1970, is presented. The findings of the early investigations and the more recent results obtained with Skylab/Apollo Telescope Mount instrumentation are discussed. Author

N76-27152# Air Weather Service, Scott AFB, Ill.
A SOLAR OPTICAL OBSERVER'S GUIDE
Richard B. Agee Sep. 1975 60 p refs
(AD-A018989; AWS-TR-75-252) Avail: NTIS CSCL 03/2

This report describes the optical manifestations of certain types of solar activity. Its intent is to assist observers, particularly inexperienced ones, in solar event detection and classification. It can serve as a quick reference in identifying solar phenomena. GRA

N76-27153# Boston Coll., Chestnut Hill, Mass. Dept. of Physics.
SPECTRAL CORRELATIONS BETWEEN SOLAR FLARE RADIO BURSTS AND ASSOCIATED PROTON FLUXES, 2
Pradip Bakshi and William Barron Jul. 1975 25 p refs
(Contract F19628-72-C-0003)
(AD-A019109; AFCRL-TR-75-0579; SR-4) Avail: NTIS CSCL 03/2

An earlier study of the solar flare U-shaped radio burst spectra and associated proton flux data has been extended to include additional events. The slope of the proton peak-flux profile is correlated to the radio frequency ratio (omega sub 3)/(omega sub 2) where (omega sub 3) equals frequency of maximum radio peak flux of the upper branch of the U, and (omega sub 2) equals cut-off frequency for the lower branch of the U. The use of the slope allows inclusion of the pre-Explorer (1966-67) events, recorded on various different proton-energy channels. GRA

N76-27154# Rice Univ., Houston, Tex. Dept. of Space Physics.
STUDY OF SOLAR WIND INTERACTIONS Final Report, 15 Jan. 1973 - 30 Sep. 1975
Alexander J. Dessler 30 Sep. 1975 155 p refs
(Contract F19628-73-C-0120; AF Proj. 8601)
(AD-A018872; AFCRL-TR-75-0543) Avail: NTIS CSCL 03/2

Advances were made in understanding of solar-wind magnetosphere interactions and the influence of the solar wind on geomagnetic activity. These advances cover a broad range of topics, including empirical studies of the solar-wind control of geomagnetic activity, theoretical studies of the coupling of solar-wind energy into the magnetosphere, observational and theoretical studies of the dynamics of the plasma sheet and its role in magnetospheric substorms, and investigations of the coupling between the magnetosphere and the ionosphere. As a direct result of this research, a limited capability was developed of predicting geomagnetic activity using parameters measured in the upstream solar wind. Journal publications supported by the contract are reproduced in order to provide a complete reporting of the salient results of contract-supported research. The report is divided into three subject categories: Part I -- Solar-Wind Magnetosphere Interactions; Part II -- Magnetosphere Tail; and Part III -- Magnetosphere-Ionosphere Interactions. The report also includes a few papers that were not supported directly by this contract; these papers represent the completion or significant extension of work that was initiated at Rice University under contract funds. GRA

N76-27155# Global Enterprises, Inc., Tucson, Ariz. Pure and Applied Science Div.
THEORETICAL STUDIES OF MAGNETIC FIELD LINE RECONNECTION AND ITS APPLICATION TO SOLAR FLARES AND MAGNETOSPHERIC DYNAMICS Final Report, 1 Jun. 1974 - 31 May 1975
Tyan Yeh 31 May 1975 45 p refs
(Contract NOAA-03-4-022-123)
(PB-249754/3; NOAA-76010705) Avail: NTIS HC $4.00 CSCL 04A

This report contains two articles. The first is entitled 'A Composite Solution of Field Line Reconnection.' In this article a solution of the MHD equations is presented which described field line reconnection by stagnant diffusion in the middle of a piecewise-uniform convective hydromagnetic flow. This composite solution demonstrates that the diffusion region adjusts its shape and size in accommodation to the incident merging fluids. The second article is entitled 'Dayside Reconnection Between a Dipolar Geomagnetic Field and a Uniform Interplanetary Field.' This article describes how field line reconnection on the dayside magnetopause is assumed to take place along the separator of field line connectivity in the magnetic topology resulting from the interpermeation of a dipolar geomagnetic field and a uniform interplanetary field. The induced voltage is calculated to show its dependence on the magnitude and direction of the incident magnetic field. GRA

N76-27156# McMath-Hulbert Observatory, Pontiac, Mich.
EXPERIMENTAL COMPREHENSIVE SOLAR FLARE INDICES FOR CERTAIN FLARES, 1970-1974
Helen W. Dodson and E. Ruth Hedeman Nov. 1975 33 p
(PB-247916-52; UAG-52; NOAA-75121701) Avail: NTIS MF $2.25; HC available from National Climatic Center, Federal Bldg. Attn: Publications, Asheville, N. C. 28801. $25.20/year, $0.60 this issue CSCL 03B

Comprehensive indices for major flares are given for 1970-74. The values of the Comprehensive Flare Index were derived for a group of flares that are considered to have been well above average in either ionizing, H or radio frequency radiation. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N76-27157 Wisconsin Univ., Madison.
THEORETICAL MODELS OF PROCESSES PRODUCING THERMAL SOFT X-RAYS IN THE INTERSTELLAR MEDIUM Ph.D. Thesis
Barham Woodford Smith 1975 172 p
Avail: Univ. Microfilms Order No. 76-6109

In the first part the extreme effects of radiative cooling on the structure of an inflow of material into the Galaxy are explored. Significantly, it is found that cooling cannot prevent the formation of a very hot (about 2 million K) corona in the flow close to the Galaxy. When it is important, however, cooling in the flow considerably increases the infall rate over the adiabatic maximum value for the same set of boundary conditions. Limits set on the flow rate and coronal density by observations of the Galaxy are discussed. In the second part it is shown that a supernova rate in the Galaxy of 1 per 50 years is sufficient to generate and maintain throughout the interstellar medium a network of interconnected tunnels containing very low-density

gas and occupying at least 20 percent of the overall volume of the disk. A detailed computer simulation of interacting supernova remnants has been constructed to study this model.
Dissert. Abstr.

N76-27158 Yale Univ., New Haven, Conn.
THE MOMENTUM SPECTRA AND ZENITH ANGLE DEPENDENCE OF COSMIC RAY MUONS Ph.D. Thesis
Richard Gregory Kellogg 1975 98 p
Avail: Univ. Microfilms Order No. 76-13614

Magnetic spectrograph measurements of the intensities of cosmic ray muons reaching sea level with arrival directions inclined at 30 and 75 deg to the zenith were presented, with a range of momenta extending from 50 GeV/c to beyond 1,000 GeV/c. The ratio between the intensities of positive and negative muons suggests that about half of all primary nucleons with energies of around 2 million Mev are neutrons. This implies that about one-third of all primary nucleons at these energies are bound in nuclei; and our measurement of the angular variation of the muon flux supports this conclusion. These results indicate that some heavy element primaries must display spectra that are significantly flatter than the spectrum of primary protons up to nucleon energies of several millions MeV. Direct measurements of the primary spectrum have verified flatter spectra for iron and several other heavy elements at energies below 100,000 MeV. Dissert. Abstr.

N76-27159 Wyoming Univ., Laramie.
PROTOTYPE ARRAY FOR THE STUDY OF EXTENSIVE AIR SHOWERS Ph.D. Thesis
Steven Felix Saterlie 1975 173 p
Avail: Univ. Microfilms Order No. 76-13523

This experiment consisted of the construction, operation, and data analysis for a three-counter prototype station for a cosmic ray air shower array. Large area (6 sq m) scintillation counters were constructed and calibrated. A special calibration procedure was shown to be necessary for large area > or equal to (4 sq m) cosmic ray counters. Three large area (3 sq m) counters were arranged at the vertices of a triangle 300 m on a side and shower data was obtained. Particle densities and relative timing among the counters were recorded. In order to analyze the data from so few counters, a theoretical model of the longitudinal and lateral electronic structure of nuclear primary air showers was developed. A total of 427 showers were fully analyzed. Dissert. Abstr.

N76-27160# Lockheed Missiles and Space Co., Palo Alto, Calif.
EFFECT OF NORTH-SOUTH ASYMMETRY OF SOLAR COSMIC RAYS AND OF PLASMA LAYER DYNAMICS AND THE DAYTIME POLAR CUSP
T. A. Ivanova, E. M. Sosnovets, and L. V. Tverskaia [1976] 6 p refs Transl. into ENGLISH from Geomagn. Aeron. (USSR), v. 16, no. 1, 1976 p 159-163
Avail: NTIS HC $3.50; National Translation Center, John Crerar Library, Chicago, Illinois 60616

Displacements of the polar and low-latitude boundaries of the auroral domains of solar protons, with E sub p approximately = 1 Mev, penetration are investigated by means of Cosmos-480 data for the April 18, 1972 flares when a northsouth asymmetry was observed in the proton intensity in the polar caps, and by means of the OGO-4 results for the case of November 2, 1967. Author

N76-27161*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COMPUTER SUBROUTINES FOR THE ESTIMATION OF NUCLEAR REACTION EFFECTS IN PROTON-TISSUE-DOSE CALCULATIONS
John W. Wilson and G. S. Khandelwal (Old Dominion Univ.) Washington Jun. 1976 25 p refs
(NASA-TM-X-3388) Avail: NTIS HC $3.50 CSCL 03B

Calculational methods for estimation of dose from external proton exposure of arbitrary convex bodies are briefly reviewed. All the necessary information for the estimation of dose in soft tissue is presented. Special emphasis is placed on retaining the effects of nuclear reaction, especially in relation to the dose equivalent. Computer subroutines to evaluate all of the relevant functions are discussed. Nuclear reaction contributions for standard space radiations are in most cases found to be significant. Many of the existing computer programs for estimating dose in which nuclear reaction effects are neglected can be readily converted to include nuclear reaction effects by use of the subroutines described herein. Author

N76-27162*# Stanford Univ., Calif. Inst. for Plasma Research.
RELATION OF THE OBSERVED FAR ULTRAVIOLET SOLAR IRRADIANCE TO THE SOLAR MAGNETIC SECTOR STRUCTURE
Donald F. Heath (NASA. Goddard Space Flight Center), John M. Wilcox, Leif Salgaard, and Thomas L. Duvall Jul. 1975 12 p refs Submitted for publication
(Contract NGR-05-020-559; Contract N00014-67-A-0112-0068; Grant NSF DES-74-19007)
(NASA-CR-148281; AD-A018765; SU-IPR-638) Avail: NTIS HC $3.50 CSCL 03/2

Comparison of the observed solar far ultraviolet irradiance and the observed solar sector structure during 1969-1972 shows a tendency for EUV maxima to be located near sector boundaries. Author (GRA)

N76-27163# Intelcom Rad Tech, San Diego, Calif.
GAMMA-RAY ENERGY DEPOSITION IN SILICON DETECTORS Final Report, 20 May 1974 - 20 Sep. 1975
N. A. Lurie Oct. 1975 55 p refs
(Contract F19628-75-C-0188; DNA Proj. NWED-QAXTA026) (AD-A020037; INTEL-RT-8136-001; AFCRL-TR-75-0562) Avail: NTIS CSCL 06/18

Calculations have been performed of total gamma-ray energy deposition spectra in a silicon ionization dosimeter based on a silicon surface barrier detector. The technique used was coupled photon-electron transport using the Monte Carlo code SANDYL. Measurements are also reported of the sensitive volume and of the nonuniformity of the charge-collection efficiency in the detector. These measurements have been used to formulate a model of the detector which leads to improved agreement between calculation and experiment. In addition, benchmark Monte Carlo calculations have been performed of the energy deposition spectra in small-geometry silicon detectors surrounded by aluminum hemispheres. Author (GRA)

99 GENERAL

No abstracts in this category.